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VOLUME 29 MAY, 1925 NUMBER 5

PARENCHYMATOUS NEPHRITIS

I. AS A GENERAL SYSTEMIC DISORDER *

S. W. CLAUSEN, M.D.

ST. LOUIS

Nephritis in children can be divided into two main classes: hemorrhagic, or glomerular, and parenchymatous, or tubular. This paper attempts to characterize the group termed "parenchymatous," to indicate the etiology and nature of the disorder, to present the differential diagnosis from hemorrhagic nephritis, and to outline the therapy.

The chief clinical features of parenchymatous nephritis are: marked edema and albuminuria, and the absence of hematuria, hypertension and retention of nonprotein nitrogen. The microscopic changes in the kidney in early cases are confined to degeneration of the tubules; in later cases, one may also observe interstitial infiltration with round cells. The hemorrhagic lesions typical of glomerular nephritis are not found. These features serve to differentiate the disorder from glomerular nephritis, as well as from other types of tubular degeneration, such as the febrile, that due to intoxication with mercury or with diphtheria toxin, and in the case of adults the nephritis of pregnancy. For the cases under consideration, the term "nephrosis" has been used by Epstein.[1]

An important etiologic factor in parenchymatous nephritis is infection with staphylococcus. In the following article,[2] it will be shown that nasal sinus infection with staphylococcus played an important rôle in each of a series of eleven cases. In six cases observed before sinus infection was definitely looked for, frequent "head colds" occurred. In one case, staphylococcus empyema, in another staphylococcus osteomyelitis, and in a third, an infected burn, preceded renal symptoms. Of the entire series of twenty-three cases, infection was not obvious in three, all of whom were infants and two of whom were not seen until moribund. No evidence exists that septicemia is necessary, as is shown by frequent negative blood cultures. Since adequate drainage of the

* Received for publication, Feb. 28, 1925.

* From the Department of Pediatrics, Washington University School of Medicine, and the St. Louis Children's Hospital.

1. Epstein, A. A.: Am. J. M. Sc. **163**:167 (Feb.) 1922.

2. Clausen, S. W.: Parenchymatous Nephritis, II. Infection of Paranasal Sinuses as Etiology, Am. J. Dis. Child., this issue, p. 587.

infected locality is followed by prompt cessation of symptoms, it appears rather that toxic substances are absorbed from the focus. Animal experiments with organisms isolated from patients have, however, been unsuccessful.

The mode of action of the hypothetical toxic substance is as yet not explained. There are good reasons for believing that it affects not merely the kidney, but also the tissues in general. Among these reasons are, that (1) nephrectomy, excepting in amphibian embryos, does not lead to edema; (2) many types of similar degeneration of the renal tubules (mercurial, diphtheritic, febrile) are not accompanied by edema; (3) cases occur in which marked edema exists without albuminuria. We have observed a patient with a heavily infected skin burn and normal urine who developed edema and ascites; theobromin sodio-salicylate promptly reduced the edema. Another instance was furnished by an infant with nasopharyngitis, edema and normal urine. (4) In parenchymatous nephritis, we have observed [3] that the surface tension of the blood and urine is remarkably lowered, and that the substance causing this effect can increase the permeability of collodion membranes for protein.[4] Such an effect, presumably occurring in the human body, would be general.

CLINICAL FEATURES

These features of parenchymatous nephritis will be discussed here only so far as they have a bearing on the thesis that this disorder is general. The relative frequency of parenchymatous nephritis in our series is about one-fifth of the total, the age of incidence is lower and the mortality, especially in the younger patients, is considerably higher than in hemorrhagic nephritis.

TABLE 1.—*Age Incidence and Mortality*

	Age, Years								
	0-1	1-3	3-5	5-7	7-9	9-11	11-13	13-15	
Hemorrhagic.....	3	8	19	25	14	12	13	13	102 Total
	2	2	2	4	3	2	2	2	19 Died
Parenchymatous.....	0	7	3	5	3	4	1	0	23 Total
	0	5	1	2	1	1	0	0	10 Died

Infection is the chief cause of death: streptococcus peritonitis in three patients; pneumonia in three patients; empyema in one patient. Two patients died of infection of unknown etiology, and one of alkalosis due to overdose of bicarbonate of soda.

3. Clausen, S. W.: Parenchymatous Nephritis, III. Surface Tension of the Blood, Am. J. Dis. Child., this issue, p. 594.

4. Clausen, S. W.: J. Biol. Chem. **59**, Proc. xiv, 1924.

Liability to infection is further shown by one patient who survived septicemia due to *Streptococcus hemolyticus* which was followed by the appearance of subcutaneous nodules; by another who went through pneumonia; and by another, with paronychia, who developed ulcers wherever she scratched her skin.

The exact cause of such susceptibility to infection deserves further study. In the three cases of peritonitis, symptoms at first were masked by ascites. The source of such infection is probably always another infected person, as seemed to be true of a patient in whom infection followed tonsillectomy performed during a ward epidemic of mild upper respiratory infection.

Pyuria was present in all cases. At necropsy the only source discovered for the leukocytes in question was the degenerating material in the renal tubules, into which polymorphonuclear cells were observed to be migrating. Alkali therapy, in our experience, is of little value.

Gastro-intestinal upsets are frequent. In seven cases, very severe, often cramp-like, epigastric pain suggested the onset of some surgical condition. The causes, however, appear to vary: peritonitis in three patients, one also showing multiple acute gastric ulcers; dysentery in two infants, and pneumonia in one older boy. Another patient had two attacks of unknown nature, one of which occurred during an epidemic called abdominal influenza.

In practically every case, the liver becomes enlarged at some time. Jaundice was seen once. Necropsy in one case showed fatty changes in the liver, and in another "parenchymatous hepatitis."

Mental symptoms somewhat like those accompanying uremia, dulness, headache and irritability occur frequently, but not muscular twitching or convulsions. It is probable that such symptoms are due to local cerebral edema. Purin diuretics or intravenous injection of hypertonic solutions or of 2 per cent. magnesium sulphate often bring prompt relief.

Twice, a peculiar syndrome—flushing of the skin, rapid heart action and large pupils—was seen which suggested stimulation of the sympathetic or paralysis of the parasympathetic.

LABORATORY EXAMINATION

The nonprotein nitrogen of the blood varied from 30 to 40 mg. per hundred cubic centimeters. The plasma and serum proteins were much reduced.[8] Fibrinogen, as determined by refractometry of serum and plasma, was always increased, 1 per cent. sometimes being found (normal, from 0.15 to 0.25 per cent.). Rapid sedimentation of the red corpuscles, supposed to accompany such an increase, did not always occur. A degree of lipemia sufficient to be visible to the naked eye was always

present in severe cases of the disorder. Five per cent. of fat was often found. Cholesterin is sometimes so much increased that it readily crystallizes on evaporating an alcoholic extract of the blood. In one of these cases multiple xanthomas appeared. The blood volume is normal, as determined by the acacia injection method. Moderate to severe anemia always occurs.

Acacia usually disappears from the blood in from twenty-four to forty-eight hours in normal persons, in patients suffering from hemorrhagic nephritis and in rabbits with uranium poisoning. In one case of parenchymatous nephritis, more than 0.1 per cent. of acacia persisted

TABLE 2.—*The Points of Distinction in Parenchymatous and Glomerular Nephritis*

	Parenchymatous Nephritis	Hemorrhagic Nephritis
Etiology, infection	Staphylococcus, especially nasal sinuses	Streptococcus, especially of tonsils
Pathology, gross	Large white kidney	Large red kidney; large white kidney in cases with anasarca
Pathology, microscopic	Degeneration of tubules; no deposits of fibrin	Hemorrhagic changes in glomeruli; deposits of fibrin
Capillaries, form	Normal	Typical changes; petechiae at times
Blood pressure	Normal	Elevated at some time
Eyegrounds	Normal always, except for lipemia and anemia; never albuminuric retinitis	Normal early, may show albuminuric retinitis
Uremia	None; cerebral edema ?	May occur
Edema	Maximal	Slight or maximal
Hematuria	None	Always, often much
Nitrogen retention	None	May be marked
Blood proteins	Low; high fibrinogen	Normal or high
Blood chlorids	Low or normal	Normal or high
Lipemia	Present	Absent except in chronic cases
Blood surface tension	Low	Normal
Phenolsulphonephthalein excretion	Normal	Low
Mosenthal test	Normal when possible	Low
Prognosis	Poor in young children	Fair
Mode of death	Intercurrent infection	Uremia
Response to purin diuretics	Good if infection subsides	Symptoms aggravated if acute
Response to high protein diet	Good	Symptoms aggravated

for six weeks; in another, for four days. This was determined both by a copper reduction method and by a color test. Since the entire amount of acacia is not in any case eliminated by the kidney, we again have evidence that in parenchymatous nephritis extrarenal factors are affected.

The elimination of phenolsulphonephthalein was normal, as was the Mosenthal test when performed during the absence of edema.

Significant is the fact that the capillaries show none of the morphologic or functional changes occurring in glomerular nephritis. The blood pressure is normal, the eyegrounds are normal, the capillaries at the nail base show at most the changes due to anemia. These capillaries can readily be seen if one uses a strong light directed at a right angle to the finger, covers the nail base with cedar oil or glycerin, and views with

a low power magnification the pink line of living skin just proximal to the nail. For comparison, it is well to examine a normal child of about the patient's age. In glomerular nephritis, one always finds changes in the capillaries of every finger, including contracted proximal arterial limb and dilated distal (venous) limb, associated with hypertension, bead-like contractions, great tortuosity, apparent abundance of capillaries and spastic contraction when a tourniquet is applied to the finger.

It has been possible, by considering several of the facts so far mentioned, to distinguish parenchymatous nephritis from the type of glomerular nephritis associated with anasarca. At least one of the characteristics of the latter group of cases is present. The points of distinction are given in tabular form (Table 2).

From a therapeutic standpoint, parenchymatous nephritis is a general disorder caused by focal infection leading to widespread tissue injury, with a further lowered resistance to infection and depletion of body protein. The indications for therapy are (1) to remove the causative infection, and (2) to restore lost body protein. The treatment of infection will be considered in the following paper.[2] The so-called eliminative treatment has not, in our experience, proved effective in producing diaphoresis or diuresis while infection persists; after treatment of infection, it usually has been unnecessary. Purine diuretics, however, do no harm and sometimes are very effective. Occasionally mechanical removal of ascites has been needed. Purgation is without justification, theoretic or practical. Transfusion, indicated for anemia, also has been of benefit in temporarily increasing blood protein. The remaining treatment is dietetic. Fluids are not restricted below 1,000 c.c. per day, even in the presence of ascites, until a diagnosis is made. A low salt diet is given. Milk and fruit comprise the diet. This, however, is quite insufficient for long periods. The diet must be rapidly increased until the patient is receiving from 2.5 to 3.5 gm. of protein and from 60 to 80 calories per kilogram of ideal weight for age and height. Since the object is to replace animal protein, the diet should include milk, casein, salt-free cheese, eggs and meat, rather than merely vegetable or cereal protein. As a source of carbohydrate, cereal, vegetables, fruit and various sugars and syrups are available. Sufficient variety is necessary. There seems to be no reason for excluding seasoning material, excepting salt. Fat, in sufficient quantity to make up the caloric needs, has not seemed harmful.[1] It is to be noted that if infection persists, such a diet alone will not bring about a cure. We have not, however, seen a high protein diet increase symptoms.

CONCLUSIONS

1. Parenchymatous nephritis is a form of nephritis distinct from hemorrhagic.

2. It is caused by focal infection with staphylococcus.

3. It consists in a widespread systemic disorder, characterized by susceptibility to infection and by loss of body protein.

4. The necessary therapy of parenchymatous nephritis includes (*a*) treatment of focal infection, and (*b*) high protein, high caloric diet.

PARENCHYMATOUS NEPHRITIS

II. INFECTION OF PARANASAL SINUSES AS ETIOLOGY *

S. W. CLAUSEN, M.D.

ST. LOUIS

In this paper, evidence that infection of the paranasal sinuses may play an important etiologic rôle in parenchymatous nephritis will be presented. The evidence consists in the demonstration that: (1) such infection was invariably present in each of a series of unselected cases; (2) exacerbations of the infection were accompanied by exaggeration of the symptoms; (3) successful treatment of the infection was followed by improvement or cure; (4) other forms of treatment were of temporary benefit only; (5) in other forms of nephritis, sinusitis is not regularly present.

The nature of parenchymatous nephritis has been more fully discussed in the preceding paper.[1] Renal lesions in parenchymatous nephritis are confined to the kidney tubules. We believe, however, that the disease affects the whole body, not merely the kidney, and that one of its important consequences is a decreased resistance to infection of all sorts. This susceptibility to infection tends to keep the nasal sinusitis active, and thus creates a vicious circle. Moreover, sinusitis is not uncommon without nephritis. This paper, therefore, does not attempt to prove that nasal sinus infection in itself is the sole cause of parenchymatous nephritis.

The cases here presented include all those patients with parenchymatous nephritis who entered the St. Louis Children's Hospital from June, 1921, to February, 1924. The diagnosis of sinus infection was made in each case. Methods of diagnosis and treatment have been reported elsewhere by Arbuckle.[2]

The table summarizes the eleven typical cases observed. Three patients were removed from the hospital without adequate treatment: J. W. developed lobar pneumonia; B. B. was taken to another clinic; L. A. refused operation. Three patients died in the hospital: E. K., of streptococcus peritonitis; A. W. of streptococcus septicemia following irrigation of antrums, and E. R., suffering from a chronic cardiac disorder, having been relieved of symptoms of parenchymatous nephritis,

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* From the Department of Pediatrics, Washington University School of Medicine, and the St. Louis Children's Hospital.

1. Clausen, S. W.: Parenchymatous Nephritis. I. As a General Systemic Disorder, Am. J. Dis. Child., this issue, p. 581.

2. Arbuckle, M. F.: Systemic Manifestations of Suppurative Disease in the Paranasal Sinuses, J. A. M. A. **81**:741 (Sept.) 1923.

after a nasal sinus operation, died a year later of heart failure. One patient, G. F., with a mild type of nephritis, was relieved of edema following medical treatment of sinusitis, and is still under observation. Four patients have recovered.

ABSTRACT OF CASES

CASE 1.—J. W., a boy, aged 7 years, entered the hospital July 29, 1921, complaining of "swelling." He had had diphtheria in November, 1920. The present illness began in February, 1921, with gradually increasing swelling of the ankles. Abdominal enlargement was noted on July 20. Examination showed anasarca, ascites and marked anemia. The nose was obstructed, the tonsils and the cervical glands were enlarged. Blood pressure was 118 systolic, 76 diastolic. The urine contained much albumin and many white blood cells. Blood nonprotein nitrogen was 31. Beginning August 8, the patient received 0.3 gm. of theobromin sodio salicylate three times a day for three days; a marked diuresis followed, and he became free of edema. Hexamethylenamin was given (0.3 gm. every four hours) on August 12, on account of persisting pus in the urine; many red blood cells appeared, but cleared up in four days after the discontinuance of the drug. Tonsillectomy was done on August 23. Phenolsulphonephthalein excretion was 70 per cent. The child was discharged August 28. At home, the patient caught a "head cold" and edema of the legs and face reappeared. On readmission to hospital on September 27, he presented the same picture as before. Albuminuria was increased. The phenolsulphonephthalein excretion was 60 per cent., the blood nonprotein nitrogen was 33 mg. Pus was found beneath the middle turbinates. Local treatment of the nasal condition with phenol-iodin petrolatum mixture was followed by decrease of this pus, and the edema was reduced without other treatment. On October 31, fever, abdominal pain, rapid respiration and increased edema were observed and signs of right lower lobar pneumonia were discovered. The parents decided to have the patient treated at home.

CASE 2.—B. J. B., a girl, aged 2½ years, entered the hospital on June 9, 1922. Nothing in the family and personal history bears on the case. June 3, 1922, the patient's eyes became puffy and the urine scanty. There was some fever. Examination showed a very edematous, pale infant, with a purulent nasal discharge; tonsils and cervical glands enlarged. Urinalysis showed from 8 to 10 gm. of albumin per liter, many white blood cells at times, and once a few red blood cells. Blood nonprotein nitrogen was 35 mg. per hundred cubic centimeters. The edema did not decrease on a milk diet, or after hot packs. Theobromin sodio salicylate administration was followed by an increase of the patient's weight. The purulent nasal discharge continued in spite of medical treatment. The parents refused surgical treatment.

CASE 3.—L. A., a boy, aged 5½ years, came into the hospital July 30, 1922, with the complaint of "acute dropsy." He had had pertussis at 3 years, "croup" at 3½ years, and removal of adenoids and tonsils at 4 years. The present trouble began June 21, after the patient had been drenched by a hose. A physician found albumin and pus in the urine, and gave so much soda (about 50 gm. per day) that the patient developed tetany. Anasarca was aggravated. Examination showed marked general edema, ascites, albuminuria (from 6 to 8 gm. per liter), blood pressure of 98 systolic, 70 diastolic, blood nonprotein nitrogen of 50. Pus was seen frequently under both middle turbinates, and found on irrigation of the antrums. This treatment did not benefit the patient. Theobromin sodio salicylate and hot packs gave no help. Low grade leukocytosis and pus from posterior nares seemed to justify a diagnosis of posterior ethmoid or sphenoid suppuration. Further operation was refused.

CASE 4.—E. K., a boy, aged 7 years, entered the hospital for the first time June 23, 1921, with generalized "swelling." He had had frequent head colds

and sore throats and was supposed to have had tuberculosis of the left tibia. The present attack of edema began in May, after the patient had been soaked by rain. The swelling rapidly subsided after the patient was put to bed, but recurred June 19, after he was again caught in the rain. Examination showed the child had low fever, general edema and a red pharynx. Careful examination of the nose was not made, as this patient entered the hospital before sinusitis was specifically looked for. Urinalysis showed much albumin, many white blood cells, blood nonprotein nitrogen was 30. The edema was rapidly reduced and the urine became practically negative on discharge, July 3. He returned to the hospital July 14, again edematous, and with much albuminuria. Blood pressure was 104 systolic, 70 diastolic; nonprotein nitrogen, 41; phenolsulphonephthalein, 65 per cent. Pus was seen in the posterior pharynx. As this cleared up, the temperature fell and the patient became free of edema. Moderate albuminuria persisted. After being at home for a week, the symptoms all recurred and the patient again returned, September 10, with a complaint of headaches, abdominal pain and generalized edema. Examination showed a profuse posterior nasal discharge, marked albuminuria, many white blood cells in urine, and blood nonprotein nitrogen 38. The administration of bicarbonate of soda was followed by increase of edema. September 18, the temperature being normal, the patient was given theobromin sodio salicylate, 0.3 gm. three times a day and edema (7 pounds) disappeared in a week. Sodium bicarbonate, given after this time, did not lead to increase of weight, but failed to keep the temperature normal. Pus was continuously present in the nose, in spite of local applications, and much albuminuria and some edema persisted. At the country convalescent home the patient gradually became more edematous, and returned to the hospital with much more purulent nasal discharge, fever and ascites. December 15, the fever became high and irregular. Nonprotein nitrogen was 45. December 19, the patient developed much epigastric pain and distention, but had no abdominal muscle spasm. Nonprotein nitrogen was 51; blood pressure, 96 systolic, 70 diastolic. Urine "boiled soiled" but contained no blood. From the abdomen 500 c.c. of pus was withdrawn, which contained many hemolytic streptococci. Necropsy also showed pus in both thoracic cavities. The kidneys showed a granular surface and in the glomeruli occasional polymorphonuclear leukocytes were seen. Tubular epithelium was granular and fatty and many nuclei had disappeared. The sphenoid cells showed extensive chronic infection.

Case 5.—A. W., a boy, aged 10 years, entered hospital May 20, 1922, with a history of swelling of face and feet of two days' duration. Examination showed edema, ascites, normal blood pressure (104 systolic, 60 diastolic), marked albuminuria, no hematuria. There was tenderness over both antrums. On May 23, pus was obtained from the right antrum, but not from the left. The temperature rose after the irrigation. On May 26, nausea, vomiting, abdominal pain and slight rigidity were noted. On May 28 the patient vomited bile and passed tarry stools. Three hundred and fifty cubic centimeters of purulent material were obtained by puncture of the abdomen. *Streptococcus hemolyticus* was present in this and in the blood culture. The patient died May 31. Necropsy showed pus in both thoracic cavities, peritonitis and multiple acute gastric ulcers. The kidneys showed mainly extensive fat deposit in the renal tubules.

Case 6.—E. R., a girl, aged 14 years, who had suffered from chronic heart disease since May, 1921, developed marked edema and albuminuria in August, 1922, without other signs of heart failure. At times there had been a purulent nasal discharge which was not benefited by local applications. The sphenoid cells were opened August 15. The edema gradually disappeared, together with the albuminuria, but definite signs of heart failure developed October 1, after overexertion. After protracted treatment, the patient died, December 13.

Case 7.—G. F., a boy, aged 12 years, who had recurring swelling of face and feet and frontal headaches "since early childhood," which symptoms were

much worse since April, 1923, entered the hospital May 11, 1923, with generalized edema and marked albuminuria. Bilateral sphenoid suppuration was diagnosed. Blood nonprotein nitrogen was 35. Phenolsulphonephthalein excretion was 52 per cent. The Wassermann reaction on mother, father and boy was positive. Antisyphilitic treatment was without effect on the edema or the albuminuria. The edema disappeared after local applications in the nose, but the albuminuria was not lessened. In March, 1924, a partial sphenoid operation was performed. The albuminuria entirely disappeared for a period, but returned later. The edema did not return.

Case 8.—A. H., a girl, aged 4 years, who was subject to long and severe colds in the head, was "chilled" while swimming, June, 1921, and became puffy under the eyes and about the ankles a few days later. A doctor found albumin, but no blood, in the urine. She became better under a milk diet and rest, but on August 30 the edema returned. She entered the hospital September 20 with anasarca, much ascites and anemia. The urine showed much albumin, many white cells and no red cells. Blood nonprotein nitrogen was 30. "Mucopus"

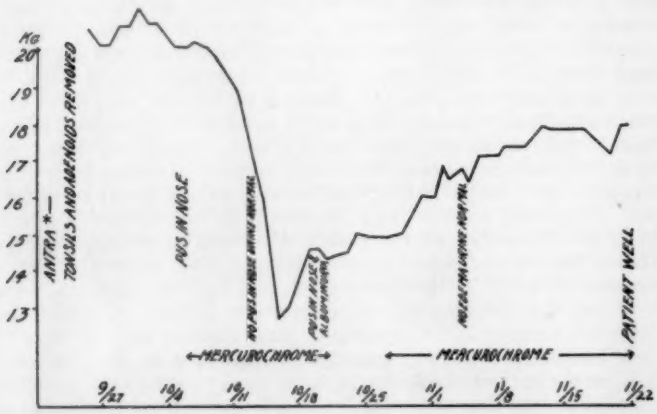

Chart 1 (Case 8).—Weight curve shows effect of treatment on edema.

was found in the nose, but washings from antrums were clear. September 22, the tonsils and adenoids were removed. The edema was not affected, and the fever continued for some days. On October 7, erythema multiforme appeared. Mercurochrome-220 soluble, 1 per cent. solution, was instilled into the nose, b. d. The nasal condition rapidly improved, the edema disappeared, and on October 13 the patient was albumin free (Chart 1). Pus again appeared in the nose on October 17, and at the same time albuminuria reappeared. As the rhinitis improved, the patient again became albumin free, and has remained so (March, 1924). On discharge, the phenolsulphonephthalein excretion was 75 per cent.

Case 9.—L. H., a girl, was first seen when 12 years old (June, 1919) because of frequent urination, puffy eyes and pallor for two months. At this time no sinus involvement was suspected, and the patient's condition seemed adequately explained by the finding of pus in the urine. A trace of albumin persisted, however, even after the disappearance of fever and pus. From this time the patient had frequent frontal headaches and nasal discharge, accompanied by puffy eyelids, swollen feet and albuminuria. In June, 1922, she entered the hospital again. There was some tenderness over the antrums and a trace of albumin in the urine constantly; blood nonprotein nitrogen and the "Mosenthal test" were normal; phenolsulphonephthalein excretion, 50 per cent., and blood pressure, 104 systolic, 66 diastolic. The tonsils and adenoids were

removed without affecting the albuminuria or the recurrent edema. In April, 1923, the edema became worse, and much more albumin was present. There was definite tenderness over the frontal sinuses. Blood pressure was 98 systolic, 75 diastolic; blood nonprotein nitrogen, 21 (plasma) and 33 (whole blood), and phenolsulphonephthalein excretion was 65 per cent. The antrums showed no pus on irrigation. With rest in bed the patient's frontal sinus tenderness disappeared and the urine became almost albumin free, but considerable quantities of pus continued to be present in the nose, in spite of local applications. On May 21, granulation tissue was removed from the left frontal sinus at operation. The albuminuria and edema disappeared and have not returned.

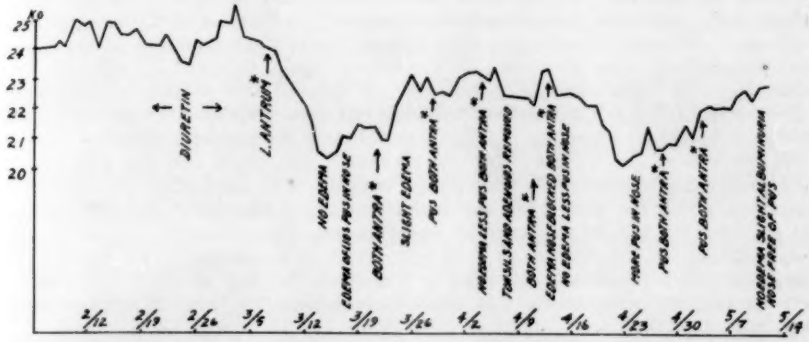

Chart 2 (Case 10).—Weight curve shows effect of treatment on edema.

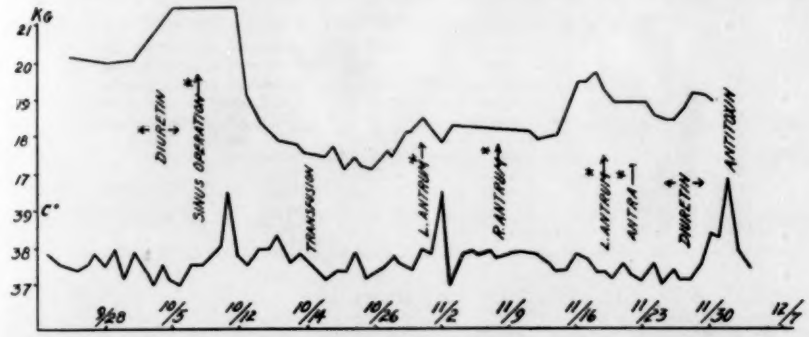

Chart 3 (Case 11).—Weight curve (upper line); temperature curve (lower line).

Case 10.—R. M., a boy, aged 6 years, developed a severe "cold" Dec. 1, 1921, with profuse nasal discharge, and on December 15 began to "swell up" and pass very little urine. Much albumin was found in the urine and at times a few red cells, but no gross blood. On treatment by rest, milk diet and hot packs, he improved until January 28, when he became worse until admission to the hospital, Feb. 5, 1922, with anasarca, marked albuminuria, fever, blood nonprotein nitrogen of 45 and blood pressure, 110 systolic, 70 diastolic. The nares were obstructed with purulent material which was proved to have originated in the antrums, as shown by irrigation with the trochar. During a hospital course of three months, the patient showed a marked tendency to recurrence of edema and of increased albuminuria which were invariably relieved by irrigation of the antrums (Chart 2). The child was discharged free of edema, but with

moderate albuminuria. His physician states that the edema has not returned and that the urine has been free of albumin for some time (March, 1924).

CASE 11.—G. S., a boy, aged 3½ years, entered the hospital in July, 1923, on account of gradually increasing edema of two months' duration. Examination showed an edematous boy with mucopurulent nasal discharge and much albuminuria. The blood nonprotein nitrogen was 41. After removal of tonsils and adenoids, the patient's nasal condition improved and the edema disappeared. Albuminuria persisted. He did well at home until September 16, when he caught cold and the urine output lessened; edema of face and feet was noted on September 17. Examination September 21 showed a slight mucopurulent nasal discharge, edema, ascites, no hematuria and the blood nonprotein nitrogen 40. A course of theobromin sodio salicylate, 0.3 gm. three times daily, for three days, was without effect. On October 2, the ethmoid and sphenoid cells and left antrums were opened; three days later the edema began to disappeared. On November 1, the edema again recurred in spite of fair drainage. A nasal culture November 19 showed the presence of virulent diphtheria bacilli and the patient's Schick test was positive. He received 5,000 units of antitoxin December 1; this was followed by severe abdominal cramps and tenderness. After this, the convalescence was rapid and the patient left the hospital December 21 with little edema. On December 26, vomiting, diarrhea and colic, with fever and leukocytosis had appeared. Another similar attack brought him to the hospital where he rapidly recovered. These attacks were thought to be due to an epidemic infection prevalent at the time. The patient's nasal condition was greatly improved, he left the hospital without edema and the albuminuria was much diminished. In June, 1924, there were no signs of nephritis.

Results of Treatment in Ten Patients

No.	Name	Admitted	Result
1	J. W.	7–19–21	Removed against advice
2	J. B.	6– 9–22	Removed against advice
3	L. A.	7–30–22	Removed against advice
4	E. K.	6–30–21	Died, streptococcic peritonitis
5	A. W.	5–20–22	Died, streptococcic septicemia
6	E. R.	3–27–22	Died, cardiac failure
7	G. F.	8– 4–23	Improved
8	A. H.	4–20–22	Well
9	L. H.	6– 4–22	Well
10	R. McC.	4– 5–22	Well
11	G. S.	7– 5–23	Well

COMMENT

It is obvious that infection is part of the picture in parenchymatous nephritis. In all cases, pus was present in the urine in such quantities as to cause a suspicion of "pyelitis." Urine cultures, unfortunately, were not made. The usual methods for treatment of pyelitis, however, were quite without effect on the systemic disorder. The removal of tonsils and adenoids was without permanent benefit. The striking and often permanent relief which followed in every instance in which a definite improvement in the nasal sinus infection could be attained, and the absence of such relief otherwise, lend strong support to the thesis that nasal sinusitis is an important factor in the causation of parenchymatous nephritis. Whether the condition in any of our patients followed an original hemorrhagic nephritis is not apparent.

The organism most frequently obtained from the sinuses at operation is the *Staphylococcus aureus* or *S. albus*. We have no further proof that this organism is the cause of the nephritis. The staphylococcus in question is not pathogenic for rabbits.

In acute hemorrhagic nephritis, which is the most frequent form observed in children, an acute streptococcus infection can usually be found. Often the sinuses are quite normal. We have no evidence that hemorrhagic nephritis is benefited by operation on the nasal sinuses.

It is worthy of note that in parenchymatous nephritis, the caffein group of diuretics is of value provided the sinus infection is subsiding; otherwise these diuretics are of little value.

In undertaking surgical relief of these patients, one must consider their increased susceptibility to infection. It was found that A. W. (Case 5), who succumbed to *Streptococcus hemolyticus* septicemia, had been operated on at a time when streptococcus infection was prevalent in the ward.

The treatment of sinus infection is, of course, not the only necessary therapeutic measure. At another place emphasis will be placed on proper dietetic measures. Quite in accord with the work of others, we have found that a relatively high protein diet is desirable. In our cases we gave from 2.5 to 3.5 grams of protein per kilogram of the patient's ideal weight. Such high protein diet is not followed by exaggeration of symptoms. The converse is true in hemorrhagic nephritis.

CONCLUSIONS

1. In a series comprising all cases of parenchymatous nephritis seen at the St. Louis Children's Hospital in a period of three years, nasal sinusitis was invariably present.

2. Evidence is presented that the sinus infection is an important factor in the causation of this disease.

PARENCHYMATOUS NEPHRITIS

III. THE SURFACE TENSION OF THE BLOOD SERUM *

S. W. CLAUSEN, M.D.

ST. LOUIS

Two important problems in the pathogenesis of "parenchymatous nephritis" are (1) the cause of the albuminuria and (2) the cause of the edema. The latter problem at least is concerned with an alteration in the equilibrium between the cells and body fluids; the most promising methods of handling such a problem are physicochemical. The present paper deals with the results obtained by applying one such method, namely, the determination of surface tension.

Substances lowering surface tension have already been found in nephritic urine. It is known that substances which lower the surface tension at a phase boundary accumulate in greater concentration at such a boundary; and it is reasonable to suppose that at the interface, changes in permeability would result. In the present paper it will be shown that a marked lowering of the surface tension of the blood serum occurs in parenchymatous nephritis; in another paper, it will be shown that in this disease substances are present which alter permeability.

METHODS

The stalagmometer of Traube was not used, because it does not permit accurate estimation of surface tension changes due to large, slowly diffusing molecules. When this work was begun, the du Noüy instrument was not available. The drop weight method of Harkins [1] appeared to offer certain advantages and was employed in the present work. It was subsequently discovered that the results obtained by this method do not necessarily correspond to those given by the du Noüy method. This is apparently due to the fact that in the technic adopted, time enough was not allowed for equilibrium to be set up. The results, however, are consistent, have undoubted comparative value, and show characteristic changes in parenchymatous nephritis.

The essential part of the apparatus (Fig. 1) is a pipet of about 0.5 c.c. capacity, blown from perfectly round fine bore tubing, about 3 mm. in diameter; the lower end, *T*, is ground flat, and must have a sharp circular edge without chips. The pipet, supported on a suitable

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1. Harkins, W. D., and Humphrey, E. C.: The Drop Weight Method for the Determination of Surface Tension, J. Am. Chem. Soc. **38**:228-236, 1916.

firm stand, is joined by a rubber tube to a three way cork, *S*, which permits air to enter *P* either through a fine capillary above *F*, protected by an inverted test tube containing a dust filter of cotton wool, or through a moderately fine capillary at *C*, joined to a long rubber tube; *F* must be so fine that for a drop of water to form and fall from *T* requires five minutes; *C* must be so fine that the drop falls in one minute. The 50 c.c. Erlenmeyer flask *E*, containing an 0.5 mm. layer of mineral oil and some mercuric iodid, is weighed and pushed onto the stopper *K*. The fluid being studied falls into the layer of mineral

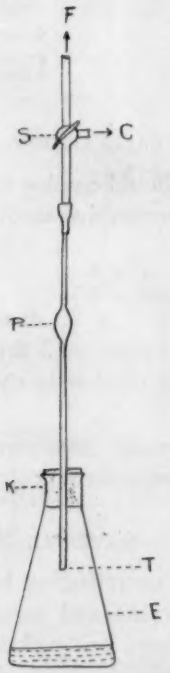

Fig. 1.—Apparatus for determining surface tension by the Harkins drop weight method.

oil. The loss of weight due to evaporation even in summer is only 1 or 2 mg. per day. When the apparatus is not in use, *P* is kept filled with bichromate cleaning solution; at such times, and between weighings, an Erlenmeyer flask is kept on *K*. A constant temperature water jacket may be used about *P*.

For use, the pipet is rinsed three times by drawing distilled water just beyond the bulb. A few drops of the fluid to be studied are drawn into the bulb and expelled; the bulb is then nearly filled, and the end is carefully wiped dry with a clean cloth free from grease. A drop is permitted to form at "high speed" and to fall at "low speed." The

latter part of the process must occupy as nearly as possible one minute (plus or minus ten seconds). The first drop is discarded. Three drops are received in the oil and weighed. For very accurate work, an allowance must be made for evaporation from the surface of the drop; this was not done in the present work.

All readings were made in a room at nearly 25 C. (from 23 to 27 C.) and a water jacket was not used. Duplicate readings were invariably averaged; they usually vary by a fraction of 1 per cent. (for example, Table 1).

TABLE 1.—*Duplicate Readings*

Readings	Water	Serum (1)	Serum (2)
I	0.1806	0.1515	0.1323
II	0.1802	0.1519	0.1318

CALCULATION

For accurate work, one should employ the empirical correction curve given by Harkins.[1] For comparative studies on body fluids it is sufficient to apply the rule:

$$\text{Surface Tension} = \frac{\text{Drop wt. of Fluid}}{\text{Drop wt. of Water}} \times 73 \text{ dynes} = 404 \times \text{drop weight.}$$

In this paper the actual weight of 3 drops will be given.

The approximate surface tension in dynes per centimeter is added in certain cases.

It is obvious that the results here reported refer to a fluid-vapor interface, which does not necessarily correspond to the interfaces in the organism.

MATERIAL

Serum was obtained by centrifuging blood as soon as it had been clotted. All hemolyzed serums and serums over twenty-four hours old were rejected, low readings being obtained in such cases. Plasma regularly has a surface tension about two dynes higher than serum, and was not included in this series.

Normal controls were obtained from patients who, while not necessarily healthy, were not suffering from nephritis, eczema or jaundice. It is sufficient to show that cases of parenchymatous nephritis have serums of low surface tension.

In Table 2 and Figure 2 the results of determinations in 100 "normal cases" are presented. The surface tension is remarkably constant about a mean drop weight of 0.1515, or 61.4 dynes. The frequency polygon is unsymmetrical, indicating that the most likely variations from the mean are toward a lower surface tension. Fever does not affect surface tension; in twenty-two patients with a temperature above 38 C., the average drop weight is 0.1515. In this series, anaphylactic conditions

did not cause marked deviations, the six cases showing an average drop weight of 0.1508 (asthmatic patients during the attacks: 0.1503, 0.1530, 0.1461, 0.1489; anaphylactic shock due to horse serum: 0.1533; angeoneurotic edema, 0.1533). These patients showing drop weight below 0.1450 are shown in Table 3.

Jaundice, even in cases not due to obstruction, is accompanied by low surface tension (icterus neonatorum, 1,412; hemolytic, 0.1385; catarrhal, 0.1400; congenital obstructive, 0.1406).

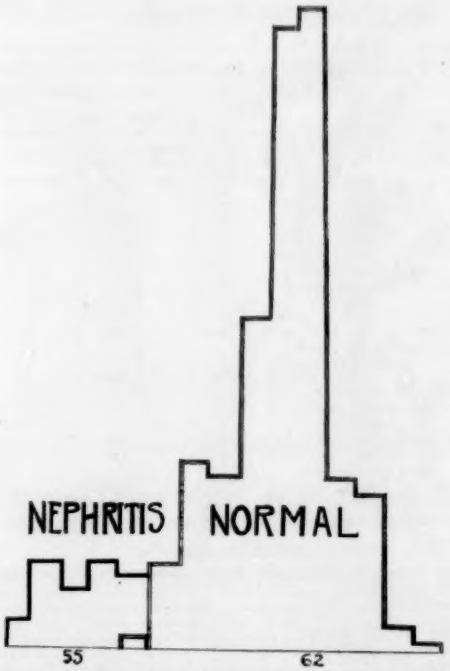

Fig. 2.—The range of surface tension of the serum of normal individuals and of those with parenchymatous nephritis. The surface tension is expressed in dynes and the height of the columns indicates the number of cases showing various surface tensions.

In eczema, under conditions not clearly understood, slight lowering of surface tension may occur.

Glomerular nephritis of the acute type shows a nearly normal distribution of surface tension values. Edema, nitrogen retention, rapid sedimentations of the red corpuscles and lipemia appear to be associated with lowered surface tension.

Cases of glomerular nephritis with anasarca do not have very low surface tension, a point distinguishing them from cases of parenchymatous nephritis. Results from some of these cases are shown in Table 5.

(M. H., R. H., J. S., A. W.) In the severe progressive types, the surface tension falls, being lowest in the chronic diffuse type (R. O., G. M.) It is noteworthy that section showed extensive renal tubular changes in both of the cases with low surface tension, whereas in J. S., with higher surface tension, an almost pure glomerular nephritis was found. This test may, therefore, be of some diagnostic value in severe nephritis with edema. During convalescence from acute glomerular nephritis the surface tension rises, often to a high normal level.

In parenchymatous nephritis the lowest values of serum surface tension are found (Table 6). In this disease, the degree of albuminuria

TABLE 2.—*Results of Determinations on One Hundred Normal Cases*

Surface Tension		Number of Cases				
Dynes	Drop Weight	Normal	Acute Glomerular Nephritis	Progressive Glomerular Nephritis	Eczema	Parenchymatous Nephritis
52.5	1300	..	..	..	..	2
52.5–53.5	1300–1325	..	..	..	..	8
53.5–	1325–1350	..	..	..	..	6
54.6–	1350–1375	..	..	..	..	5
55.6–	1375–1400	..	..	1	..	5
56.6–	1400–1425	2	..	2	..	2
57.6–	1425–1450	4	..	5	5	2
58.6–	1450–1475	10	2	2	1	1
59.7–	1475–1500	12	6	3	5	..
60.7–	1500–1525	26	8	1	5	..
61.7–	1525–1550	27	12	4	4	..
62.8–	1550–1575	9	6	1	4	..
63.8–	1575–1600	8	3	1	1	..
64.8–	1600–1625	1	3	..	..	..
65.8–66.8	1625–1650	1	..	..	..	..

TABLE 3.—*Patients Showing Drop Weight Deviation*

Case	Cause	Drop Weight
M. L.	Parenchymatous hepatitis diagnosed from tissue removed at operation (without jaundice)	0.1408
V. W.	Hemorrhagic purpura	0.1435
N. B.	Chorea	0.1441
A. L.	Plastic operation, badly infected	0.1423
C. B.	Cachetic edema in tubercular patient	0.1437
J. R.	Diabetes insipidus	0.1447

seems to be directly correlated with low serum surface tension. Whether edema develops in such cases apparently depends to a striking degree on the concentration of serum protein. Those cases with serum protein below 5 per cent. invariably were edematous. According to preliminary experiments, this corresponds roughly to an effective colloidal osmotic pressure of about 22 cm. of water, a value perhaps below the capillary pressure. Such patients are temporarily benefited by transfusion of blood or injection of acacia. Fatal cases showed the lowest surface tension (E. K., L. A., W. H.). In those cases in which recovery was observed, the surface tension became normal (E. R., A. H., G. S., L. O'N.). In nutritional edema, which bears other resemblances to parenchymatous nephritis, low surface tension also is observed.

TABLE 4.—*Surface Tension in Acute Glomerular Nephritis*

Kind	Number	Average Drop Weight
Acute, without edema	21	0.1529
Acute, with edema	18	0.1489
Nonprotein nitrogen over 50, not uremic	6	0.1446
Nonprotein nitrogen over 50, uremic	9	0.1490
Lipemia	5	0.1449
Rapid sedimentation	5	0.1494

TABLE 5.—*Glomerular Nephritis*

Acute Cases with Improvement

Case	Name	Date	Drop Weight	Remarks
1	L. H.	5/ 4/22	0.1516	Pyelitis, no hematuria
		5/12/22	0.1489	Onset of hematuria, nephritic
		5/18/24	0.1541	Urine blood free; trace albumin
2	C. R.	5/ 4/22	0.1496	Hematuria
		5/23/24	0.1551	No hematuria; slight albuminuria
		5/25/24	0.1553	No hematuria; slight albuminuria
		5/30/24	0.1501	No hematuria; slight albuminuria
3	R. C.	12/ 8/21	0.1545	Acute postscarlatinal nonprotein nitrogen 46
		12/12/21	0.1530	Anuria, nonprotein nitrogen 172, little or no edema
		5/ 4/22	0.1495	No albuminuria
4	M. B.	5/ 9/22	0.1536	Edema, hematuria, nonprotein nitrogen 57
		5/18/22	0.1540	Albumin free
		5/27/22	0.1482	Albumin free
5	M. H.	1/ 2/24	0.1459	Insidious onset; anasarca; hypertension; retinitis; nonprotein nitrogen 35
		1/10/24	0.1444	Edema, improved
		1/30/24	0.1453	Slight edema
		2/11/24	0.1553	Edema, much general improvement
		2/25/24	0.1573	Sphenoid operation, temporary exacerbation of hematuria
		3/ 5/24	0.1548	Much better; albuminuria persists
6	R. H.	3/ 1/24	0.1482	Sick one month; anasarca; hematuria; nonprotein nitrogen 50
		3/ 5/24	0.1497	Losing edema; blood pressure 140/100
		6/30/24	0.1525	Trace albumin at times, slight hematuria; no edema; blood pressure 120/20

Progressive Fatal Cases

1	R. O.	11/25/22	0.1442	Sick three years; blood pressure 230/190; nonprotein nitrogen 95; retinitis
		12/21/22	0.1417	Uremia; nonprotein nitrogen 124; no edema
		1/18/23	0.1412	Edema of feet; nonprotein nitrogen 150
		2/ 5/23	0.1384	Nonprotein nitrogen 360; necropsy: chronic diffuse nephritis
2	J. S.	3/ 5/24	0.1518	Sick nine weeks; nonprotein nitrogen 118; blood pressure 95/70; anasarca
		3/17/24	0.1441	Nonprotein nitrogen 170, uremia; necropsy: pure glomerular nephritis
3	A. W.	4/ 3/24	0.1572	Gradual onset, anasarca, nonprotein nitrogen 185, blood pressure 115
		4/ 7/24	0.1545	Uremia
		4/ 9/24	0.1545	
		4/22/24	0.1527	
		4/29/24	0.1533	
		5/ 2/24	.....	Died; no necropsy
4	G. M.	6/15/21	0.1278	Sick one month; anasarca; hematuria; nonprotein nitrogen 58
		6/23/21	0.1326	Blood pressure 130/80; nonprotein nitrogen 80
		8/21/21	.....	Necropsy: marked glomerular and tubular changes

The determination has been of value in distinguishing cardiac edema from edema due to parenchymentous nephritis (M. K., 0.1532; J. C., 0.1535; B. S., 0.1539; A. C., 0.1535).

On account of the coexistence of low serum surface tension and of low serum protein in parenchymatous nephritis, it became of interest

TABLE 6.—*Parenchymatous Nephritis*

Case	Date	Drop Weight	Serum Protein, per Cent.	Edema	Albuminuria	Remarks
1. S. M.	5/30/21	0.1377	6.7	++	++++	
	6/16	0.1365	4.6	+++	++++	
2. H.	6/14/21	0.1336	...	++++	++++	
3. J. W.	9/ 2/21	0.1350	6.0	0	++++	
	9/27	0.1364	...	.....	+++	
	10/31	0.1419	...	+	++++	Pneumonia
4. E. K.	9/ 2/21	0.1324	5.5	0	++++	Recent loss of edema
	9/22	0.1350	...	0	++	
	12/16	0.1489	...	+	+++	Peritonitis
	12/20	0.1273	...	++	++++	Moribund
5. R. McC.	3/12/22	0.1343	4.0	++++	++++	
	3/17	0.1313	...	++++	++++	Edema increased
	5/ 2	0.1333	7.7	±	++++	Recent loss of edema
	5/ 8	0.1320	7.2	0	++++	
6. A. W.	5/22/22	0.1435	5.0	+	++++	Moderate edema
	5/25	0.1395	4.6	++	++++	
	5/27	0.1389	4.3	+++	++++	Peritonitis
7. B. B.	6/10/22	0.1441	4.4	+++	+++	
	6/15	0.1308	5.0	++	++++	
8. E. R.	6/22/22	0.1392	...	+++	++++	No cardiac decompensation
	11/20/22	0.1596	7.0	++++	++	Cardiac failure
9. L. A.	7/11/22	0.1218	...	++++	++++	Died
10. A. H.	5/11/22	0.1417	4.0	++++	++++	
	11/14/22	0.1497	7.2	0	0	
11. G. S.	8/ 3/23	0.1300	5.0	++++	++++	Nonprotein nitrogen 41
	8/ 9	0.1384	...	++	++++	Improvement.
	10/ 4	0.1336	...	++++	++++	Relapse, ethmoid operation
	10/10	0.1333	5.9	++	+++	
	10/15	0.1340	4.2	+	+++	
	10/18	0.1559	5.8	0	++	Marked edema, improvement
	10/22	0.1335	...	±	+++	Diphtheria
	12/20	0.1416	...	0	+++	Very much better
	1/10/24	0.1300	5.0	±	++++	Epigastric pain
	1/30	0.1370	5.4	0	+++	
	4/ 2	0.1366	...	0	+++	
	4/ 7	0.1413	7.1	0	+	
	4/ 9	0.1386	6.4	0	++	
	4/11	0.1336	6.2	0	+++	
	4/22	0.1547	8.1	0	++	
	4/29	0.1575	7.9	0	±	No signs of nephritis
12. L. O'N.	9/ 3/21	0.1396	...	++++	++++	Secondary to bronchiectasis
	10/13/22	0.1517	...	0	++++	
	10/15/23	0.1516	...	0	0	
13. W. H.	10/ 4/21	0.1365	...	++++	++++	Infant
	10/20/21	0.1305	...	++++	++++	B. streptococcus sepsis
14. I. M.	6/15/21	0.1323	...	+++	++++	

TABLE 7.—*Surface Tension*

Case	Cause	Drop Weight
W. L.	Diabetes mellitus	0.1336
W. S.	"Mehlnährschaden"	0.1205
C. B.	Tubercular with cachexia	0.1437

to correlate these determinations in various conditions (Table 8). The serum protein was determined by the refractometer, excepting in cases of lipemia, in which total and nonprotein nitrogen served as basis for the calculation. Although the number of observations is limited, the corre-

lation charts bring out the facts that in acute glomerular nephritis there is a slight increase of surface tension with a considerable increase of protein; in eczema, there is a "spreading" effect, with tendency for moderately low surface tension and very low protein, whereas in parenchymatous nephritis the striking lowering of both surface tension and protein is again evident.

TABLE 8.—*Correlation Between Serum Surface Tension and Serum Protein, Expressed as Cases Per Hundred*

Per Cent.	1300-1350	1350-1400	1400-1450	1450-1500	1500-1550	1550-1600	Total
Normal, 69 Cases							
3-4	..	..	..	..	..	..	..
4-5	..	..	..	..	..	..	..
5-6	..	..	..	1	..	..	1
6-7	..	..	4	4	11	3	22
7-8	..	..	4	9	36	6	55
8-9	..	..	1	9	10	1	21
9-10	..	..	1	..	..	..	1
Total	..	..	10	23	57	10	100
Eczema, 21 Cases							
3-4	..	..	..	5	..	..	5
5-6	..	..	5	5	5	..	15
6-7	..	..	5	5	5	5	20
7-8	..	..	9	5	23	5	42
8-9	..	..	..	..	..	5	5
9-10	..	..	..	..	..	..	..
Total	..	..	19	25	41	15	100

Per Cent.	1300-1350	1350-1400	1400-1450	1450-1500	1500-1550	1550-1600	1600-1650	Total
Acute Glomerular Nephritis, 25 Cases								
3-4	..	..	..	..	..	..	..	..
4-5	..	..	..	..	..	..	..	..
5-6	..	..	..	..	..	..	..	..
6-7	..	..	..	4	4	..	..	8
7-8	..	..	..	15	30	4	..	49
8-9	..	..	..	4	15	4	..	23
9-10	..	..	..	4	8	4	4	20
Total	..	..	..	27	57	12	4	100
Parenchymatous Nephritis, 15 Cases								
3-4	..	..	..	..	..	..	..	..
4-5	7	20	13	..	..	..	..	40
5-6	20	7	7	..	..	..	..	34
6-7	..	13	..	..	..	..	..	13
7-8	13	..	..	..	..	..	..	13
8-9	..	..	..	..	..	..	..	..
9-10	..	..	..	..	..	..	..	..
Total	40	40	20	..	..	..	..	100

Subjects for further investigation include the origin, nature and action of the surface active materials.

CONCLUSIONS

1. Serum surface tension, as determined by the drop weight method, is remarkably constant in health and in many diseases.

2. In glomerular nephritis the surface tension is slightly increased.

3. In cardiac edema, the serum surface tension is not decreased.

4. In parenchymatous nephritis, the surface tension is much diminished. As the surface tension returns to normal, albuminuria diminishes.

5. Edema in parenchymatous nephritis is correlated with low serum protein.

6. Incomplete correlation exists between low serum surface tension and low serum protein in a variety of conditions.

CLINICAL OBSERVATIONS ON CRANIOTABES AND RICKETS*

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REVIEW OF THE LITERATURE

All through the extensive studies of recent years in rickets, little has been done to investigate craniotabes. In the past, some investigators, notably Kassowitz [1] and later Wieland,[2] concerned themselves with the etiology and pathology of this clinical condition. They found it frequently associated with rickets, and the former believed that craniotabes was a manifestation of rickets and that all rickets, therefore, was congenital in origin. Wieland,[3] Schloss [4] and Finkelstein [5] believed that the early congenital softenings were physiologic in nature and soon disappeared, while new softenings appearing on the hard bone later were "rachitic." Czerny [6] states that craniotabes makes a positive diagnosis of rickets. Marfan [7] says that true craniotabes is of rachitic origin, but believes syphilis to be the most common cause of craniotabes. De Stefano [8] states that craniotabes is a manifestation either of rickets or of inherited syphilis. Thus, we see that most of the investigators believe that craniotabes is a manifestation of rickets.

With the hope of throwing more light on the question of craniotabes and its relation to rickets, we have undertaken this clinical study.

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* From the Feeding Clinic, Pediatric Department, of the Jewish Hospital.
* Read before the Brooklyn Pediatric Society, Jan. 23, 1924.

1. Kassowitz: Rachitis, Jahrb. f. Kinderh. **75**:194, 334, 489, 581; **76**:369; **77**:277, 1912-1913.

2. Wieland: Die Kassowitzche irrlehre von der Angeborener Rachitis, Jahrb. f. Kinderh. **84**:360, 1916.

3. Wieland: Die Rachitische Wachstumstorung des Skeletts, Bruning-Schwalbe Handbuch des Allgemimen Pathologie des Kindesalters, 244-279, 1913.

4. Schloss, E.: Ueber Rachitis, Berl. Klin. Wchnschr. **53**:106-109 (Jan. 31) 1916; ibid. 743-747 (July 3) 1916; ibid. 1340 (Dec. 11) 1916; ibid. 1366 (Dec. 18) 1916; ibid. 1391 (Dec. 25) 1916.

5. Finkelstein: Lehrbuch der Sauglins-Krankheit, Zweite Auflage, Berlin, Julius Springer, 1921.

6. Czerny: Rachitis—Kraus und Brush, Spez. Path. und Therapie In Krankh., 1921.

7. Marfan, A. B.: Craniotabes in Infants, Paris méd. **11**:493-500 (Dec. 24) 1921; Abstr. J. A. M. A. **78**:689 (March 4) 1922.

8. De Stefano, S.: Craniotabes in Relation to Rickets and Inherited Syphilis, Pediatria **29**:59 (Jan. 15) 1921; Abstr. J. A. M. A. **77**:976 (Sept. 17) 1921.

METHOD OF EXAMINATION

When looking for craniotabes, we put the baby flat on its back, facing the examiner. The skull is then palpated with the fingers of both hands and any softening of the bone is recorded. We differentiate between "true craniotabes" and the giving way or softening of the bone at the suture lines. In our studies we only included "true craniotabes" occurring in two types: (1) the extensive soft skull giving a membranous sensation, and (2) the thin, dry skull giving a crackling, parchment-like sensation.

RELATION OF CRANIOTABES TO RICKETS

In our series of 469 babies under 1 year of age, 164, or 35 per cent., had craniotabes, and 121, or 25 per cent., showed clinical rickets. Of the latter only forty-eight, or 39 per cent., had craniotabes, a figure quite close to the incidence of craniotabes (35 per cent.) in our entire series.

It is often asked how frequently do these babies with craniotabes develop rickets later? Most of the babies with craniotabes in Levinson's series [9] either had rickets or later developed the condition. Only five

Age and Incidence of Rickets, with Positive Roentgen-Ray Findings in Thirty-One Babies with Craniotabes

	Age												
	1 Mo.	2 Mo.	3 Mo.	4 Mo.	5 Mo.	6 Mo.	7 Mo.	8 Mo.	9 Mo.	10 Mo.	11 Mo.	12 Mo.	Total
Positive rickets.....	0	0	0	2	1	3	1	0	1	1	0	0	9
Negative rickets.....	0	2	4	4	4	3	0	4	1	0	0	0	22

babies with marked craniotabes failed to develop rickets later. As 99 per cent. of the babies in this series were colored, the high incidence of rickets can be explained by the racial predisposition to the condition.

Of the 164 babies with craniotabes in our series, forty-eight, or 29 per cent., had, or later developed, clinical rickets. This is rather close to the incidence of rickets in our entire series, namely, 25 per cent. Seventeen babies in this series had marked craniotabes and only three, or 17 per cent., had, or later developed, rickets. Thirty-one babies of the before-mentioned craniotabes series, taken at random without regard to whether or not they had clinical rickets, had routine roentgenograms of the wrists and ankles. Nine of these, or 29 per cent. (see table), were found to have rachitic changes in the long bones, again a figure quite close to the usual incidence of rickets in our entire series.

9. Levinson, A.: Studies in Craniotabes, Arch. Pediat. **38**:24 (Jan.) 1921.

INCIDENCE OF CRANIOTABES

Influence of Feeding, Sex and Race.—In full accord with the observations of Levinson [9] and Hughes,[10] we have found that neither the kind of feeding nor the sex influences the incidence of craniotabes. However, we have observed a greater predisposition to craniotabes in colored than in white babies.

Age Incidence.—Levinson,[9] Hughes [10] and Schwartz [11] have shown that craniotabes occurs most frequently between the first and fourth months of life. The greatest number in our series appeared between the third and fourth months, with a fair number occurring in the first

Chart 1.—Age incidence in rickets and craniotabes. Black line, craniotabes; dash line, rickets.

month. This is contrary to our findings in rickets, which show the greatest frequency in the third and fourth quarters of life. This is well demonstrated in Chart 1.

Seasonal Incidence.—The seasons of the year play a very important rôle in the occurrence as well as in the disappearance of craniotabes. Practically no attention had been paid in the recent studies to this seasonal influence. Kassowitz [1] was the first to observe that babies born in the spring and early summer develop craniotabes more frequently than those born in the second half of the year. This observation was

10. Hughes, Edward: Clinical Study of Craniotabes, Lancet **2**:36 (July 13) 1918; ibid., **2**:1045 (Nov. 19) 1921.

11. Schwartz, H.: Craniotabes and Beading of Ribs as Signs of Rickets, Am. J. Dis. Child. **19**:384 (May) 1920.

refuted by Wieland, who showed that craniotabes develops as frequently during the second half of the year as during the first. In our series, routine examinations were made once in two weeks on all babies admitted under 1 year of age, in order to determine the exact time of the year when craniotabes appeared. In the 164 cases of craniotabes in children under 1 year of age, we found this condition most prevalent during

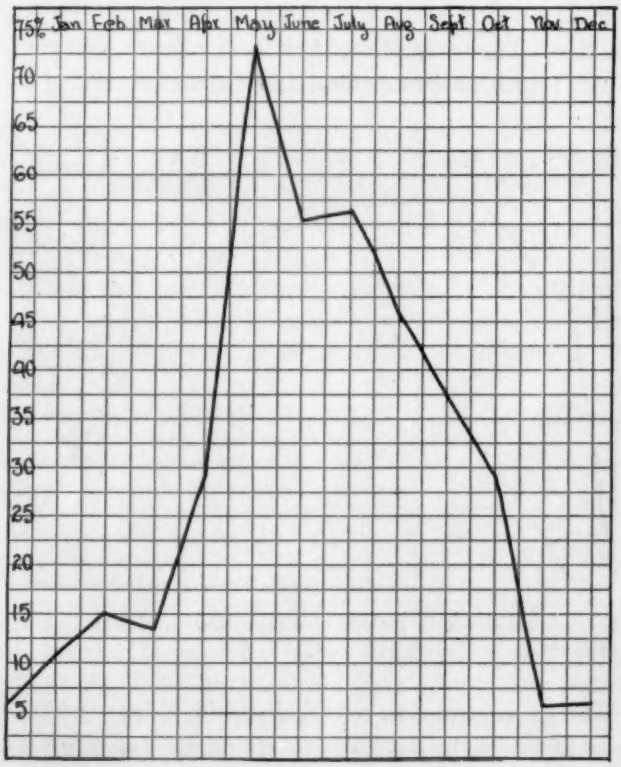

Chart 2.—Seasonal influence on the occurrence of craniotabes. The percentage denotes the number of cases of craniotabes, in relation to the total number of babies under 1 year of age, admitted each month.

the late spring and early summer. This is shown graphically in Chart 2.

This figure shows a gradual rise during the spring, reaching its peak during the early summer and then gradually falling. The disease is practically absent in the winter months. When superimposed on the curve of the seasonal incidence of rickets, the differences in the two curves are quite apparent. When craniotabes shows a decline, rickets is still on the up grade (Chart 3).

EFFECT OF TREATMENT ON THE DISAPPEARANCE OF CRANIOTABES

Of 106 babies with craniotabes, thirty were kept on cod liver oil, thirty-six were exposed to sunlight, and in forty breast fed infants the mother's diet was regulated. The effect of these therapeutic agents on the disappearance of craniotabes was noted. In the breast fed group, special stress was laid on an ample amount of milk, cream, butter-fat and leafy vegetables as essential components of the mother's diet. The

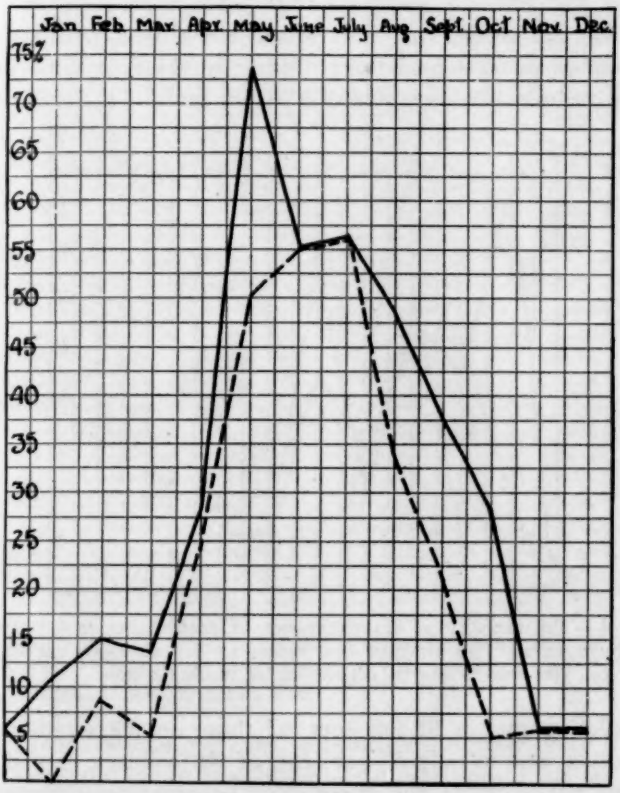

Chart 3.—Seasonal influence on the occurrence of craniotabes and rickets. The percentage denotes the number of cases of craniotabes in relation to the total number of babies under 1 year of age, admitted each month. The straight line refers to craniotabes, the dash line to rickets.

babies treated with cod liver oil were given from 0.5 to 1 dram of the oil three times a day. Those treated by sunlight were ordered exposed directly to the sun's rays for at least fifteen minutes twice daily. They wore only a napkin and a sleeveless shirt. As these observations were made in an outpatient clinic, we could not always tell whether our orders were carried out or not, unless we had certain criteria to go by. We, therefore, guided ourselves by questioning the mothers closely at

each visit, and by routine calls of our visiting nurses to the patients' homes. The data thus obtained gave us a fair idea of the amount of cod liver oil taken by each baby, or the kind of food consumed by the mother. The index of exposure to sunlight was the degree of tanning of the skin, with due allowances made for individual variations. Examinations were made regularly every two weeks, and the extent of the craniotabes was noted independently by two observers at each examination. Many children were kept under observation for a long time after the clinical evidence of craniotabes had disappeared. These observations are plotted on Chart 4, and show the rapid disappearance of craniotabes under heliotherapy. Thus, in the first three months of treatment, craniotabes disappeared in 91 per cent. of the children under-

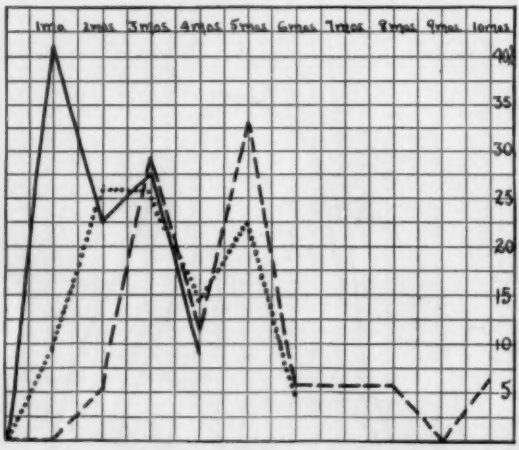

Chart 4.—The rapidity of disappearance of craniotabes under the different therapeutic agents. The straight line refers to heliotherapy, the dash line to cod liver oil, the dotted line to regulation of mother's diet.

going heliotherapy; in 61 per cent. of those on the regulation of the mother's diet, and in only 33 per cent. of the children on cod liver oil. Forty-two per cent. of the cures with heliotherapy occurred in one month, while only a few were cured through regulation of the mother's diet and none on cod liver oil within the same period of time.

This concurs with the observations of Ludwig Meyer [12] on heliotherapy and of Levinson [9] on cod liver oil. Meyer treated a number of patients with ultraviolet rays and recovery was very prompt: in fourteen days, one-half the craniotabes disappeared, and in from four to five weeks there was complete calcification. Levinson found that cod liver oil did not have much effect on craniotabes. Our observations, as shown in Chart 4, apparently run in the same channels. We have observed

12. Meyer, L.: Rickets, Internat. Clin. 4:176, 1921.

craniotabes develop in babies to whom cod liver oil was administered for a month before its initial appearance. In several instances we have also seen slight craniotabes gradually increase to marked craniotabes, though cod liver oil was being administered during this period. One must not overlook the fact, however, that the low figures for cod liver oil therapy might be found in the irregular and inadequate administration of the oil among outdoor clinic patients. In addition to the foregoing

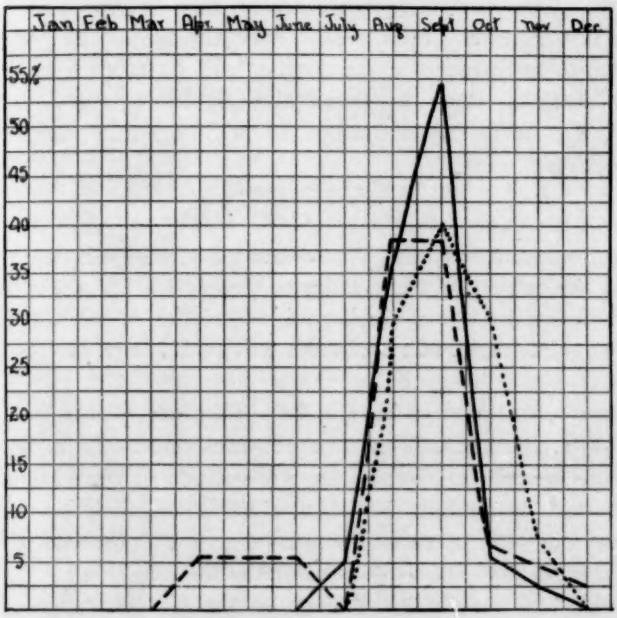

Chart 5.—Influence of season on the disappearance of craniotabes. The straight line refers to heliotherapy; the dash line to cod liver oil, the dotted line refers to regulation of mother's diet.

therapeutic observations, we tried to estimate the importance of certain factors, such as the age of the patient and the season of the year, on the rapidity of recovery (Chart 5).

INFLUENCE OF AGE AND SEASON ON THE DISAPPEARANCE OF CRANIOTABES

Without close analysis, the age of the baby may seem to determine the disappearance of craniotabes. The greatest number of babies seem to be cured during the second and third quarters of life. Levinson[9] lays much stress on the age factor. He states that practically all craniotabes disappears at the age of 7 or 8 months, but says nothing about the influence of season. As shown in Chart 5, season has a powerful

influence on the disappearance of craniotabes, irrespective of the kind of therapeutic agent employed, a total of 93 per cent. being cured in August, September and October. The same seasonal influence was found by Hess and Unger [13] in their study of rickets; they have interpreted this to be due to hygienic factors, especially sunlight. Our observations on the age incidence of craniotabes (Chart 1) show that the age at the onset is, in most instances, 2, 3 and 4 months, and the seasonal influence (Chart 2) shows it to occur mostly in the first half of the year. The curative summer season then follows and the effect is seen in four months. Incidentally, only, the age of the babies at the time of the disappearance of craniotabes will be from 6 to 8 months. We have observed cases of craniotabes in babies, aged from 8 to 9 months, that were cured during the summer, thus supporting the before-mentioned view.

SUMMARY

1. One hundred and sixty-four cases of craniotabes were studied.

2. The association of craniotabes to rickets was found to be inconsistent, and inference was made that this association is only a coincidence.

3. The age incidence of craniotabes was found to be earlier than that of rickets.

4. Season was found to have a definite influence on the occurrence of craniotabes, the greatest number of cases appearing in May, June and July, and a lesser number of cases at the end of the summer.

5. Exposure to sunlight had a marked beneficial effect on craniotabes: in 42 per cent. of cases the areas calcified at the end of the first month, and in 91 per cent. at the end of the third month.

6. Season had a definite influence on the disappearance of craniotabes, 93 per cent. of the patients being cured in August and September, irrespective of the kind of therapeutic agent employed.

7. Season, rather than age, is suggested as the main factor in the disappearance of craniotabes.

CONCLUSION

No definite conclusion as to the relationship of craniotabes to rickets can be drawn from these observations without a study of the calcium and phosphorus concentrations in the blood of these babies. This was done in about thirteen well selected cases and was reported with conclusions elsewhere.[14]

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13. Hess, A. F., and Unger, L. J.: An Interpretation of the Seasonal Variation of Rickets, Am. J. Dis. Child. **22**:186 (Aug.) 1921.

14. Wilson, S. J., and Kramer, S. D.: Proc. New York Path. Soc. **23**:226 (Dec.) 1923.

THE DISTRIBUTION OF INORGANIC PHOSPHORUS IN THE BLOOD OF THE NEW-BORN *

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In a study shortly to be completed, the subject of the variation in inorganic phosphorus content of the blood of the new-born at different seasons of the year has been investigated. For the purpose of determining this seasonal variation, the blood of the umbilical cord was used as the index of the infant's blood as a whole.

Most investigators [1] have used cord blood as representative of the infant's blood. Anatomically considered, it is an integral part of the fetal circulation, and the umbilical vein is the ultimate continuation of the umbilical arteries.

As differences appeared when blood from other sources in the fetal circulation was examined and compared with cord blood, the question arose as to whether cord blood was a true index of the infant's blood, and, furthermore, whether a substance such as Wharton's jelly would contribute to its fluid content thus diluting the blood and rendering its phosphorus content inaccurate. Therefore, in conjunction with the whole cord blood, simultaneous examinations of the inorganic phosphorus of the following four sources were also made: (*a*) arterial blood of the cord, (*b*) venous blood of the cord, (*c*) blood from the superior longitudinal sinus and (*d*) venous blood from the mother.

Our investigations showed decided differences and variations in the samples of blood from these five sources.

PROCEDURE

Our method of procedure to obtain blood from the infant is as follows: At the moment of birth, and while the cord is still pulsating, it is tied off close to the infant and at the vulva of the mother. Two

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* From the Pediatric Service, Harlem Hospital, and Department of Chemistry, Fordham University.
* The expenses of this investigation have been defrayed by a fund, generously donated by Mr. Ernst Rosenfeld.

1. Howland, John, and Marriott, W. McK.: Tr. Am. Pediat. Soc. **28**:209, 1916. Hess, Alfred F., and Matzner, Milton J.: Rickets in Relation to the Inorganic Phosphate and Calcium in Maternal and Fetal Blood, Am. J. Dis. Child. **26**:285 (Sept.) 1923.

ligatures are placed in the middle of the cord and the cord cut between them; one portion is allowed to drip to obtain what we have called whole cord blood, and the other portion is used to obtain blood from the two arteries and vein. The latter procedure requires considerable care and dexterity. After identifying the umbilical arteries by their size and color, they are aspirated with a fine needle and syringe. They collapse, and the vein, which stands out very prominently, is then similarly depleted. Blood is obtained from the mother just before the birth of the child, and from the superior longitudinal sinus following the ligature of the cord.

TABLE 1.—*Results of Inorganic Phosphorus Determinations*

Vein of the Cord Blood	Arterial Blood	Percentage Arterial Phosphorus	Average of Venous and Arterial Blood	Phosphorus Values in Cord Blood	Difference Between Phosphorus Values in Cord Blood and Venous and Arterial Blood
7.1w	6.92	49	7.05	7.47	0.42
4.11	5.67	58	4.89	5.06	0.17
4.24	6.23	59	5.23	5.49	0.26
3.88	3.22	46	3.55	3.48	0.07
5.61	5.49	49	5.55	5.65	0.10
5.11	5.00	49	5.06	5.18	0.12
3.28	3.42	51	3.35	3.36	0.01
3.36	3.88	53	3.63	3.48	0.15
3.98	4.44	53	4.11	4.16	0.05
3.72	4.21	53	3.96	3.88	0.08
3.50	4.42	56	3.96	4.06	0.10
4.00	4.84	54	4.47	4.33	0.14
2.83	3.28	54	3.05	3.02	0.03
3.09	3.46	55	3.28	3.27	0.01
2.98	3.52	55	3.20	3.10	0.10
3.07	3.89	56	3.48	3.48	0.00
4.17	5.18	50	4.67	4.64	0.03
3.50	4.60	57	4.05	4.00	0.05
Average.....					0.072

In all instances, the inorganic phosphorus determinations were made immediately after collecting the blood by the Briggs modification of the Bell-Doisy method.

The results are given in Tables 1 and 2. The figures represent milligrams of phosphorus per hundred cubic centimeters of whole blood.

In the first column of Table 1 are given the phosphorus figures in the vein of the cord, and in the second column are seen the phosphorus figures found in the arterial blood. These data, with the exception of four cases which seem anomalous and are set aside by themselves, are arranged in the order of relative increase in amounts of arterial phosphorus. In the third column this increase in arterial phosphorus is made more evident by calculating its percentage in terms of the sum of arterial and venous phosphorus. With two exceptions the arterial phosphorus is in excess of the venous, and this relationship is so consistent that it cannot be considered as a mere coincidence.

The average of venous and arterial blood is given in the fourth column, and may be compared with the phosphorus values in the so-called cord blood, which are given in the fifth column. These two values are in excellent agreement, their differences having an average of only 0.072 mg. and we may therefore conclude that cord blood, as usually taken, is a true sample of the arterial and venous blood.

The inorganic phosphorus content of the mother's venous blood, the cord blood and the fontanel blood of the infant are compared in Table 2. The cases are arranged in order of deviation between cord and fontanel. Note that the phosphorus of maternal blood is usually lower than that of the cord. This is in accordance with other investi-

TABLE 2.—*Results of Inorganic Phosphorus Determinations*

Mother's Venous Blood	Cord Blood	Fontanel Blood	Fontanel Exceeding Cord
2.66	3.38	3.41	0.03
3.07	3.73	3.88	0.15
2.97	4.60	4.94	0.34
4.25	3.88	4.33	0.45
2.59	3.48	3.98	0.50
3.10	3.95	4.64	0.69
2.97	3.88	4.65	0.77
2.57	3.32	4.35	1.02
2.50	4.67	5.70	1.03
4.15	2.40	4.20	1.80
3.22	3.27	5.34	2.07
5.26	5.63	7.71	2.08
			0.915
			Cord Exceeding Fontanel
2.03	4.06	3.01	1.05
3.98	5.80	4.80	1.00
3.94	5.18	4.56	0.62
3.20	4.51	3.98	0.62
2.97	4.17	3.79	0.38
2.86	3.48	3.10	0.38
3.36	4.16	3.79	0.37
2.46	2.82	2.80	0.02
3.16	3.36	3.35	0.01
			0.445

gators,[2] and in our experience in over 1,500 phosphorus determinations, this relationship always exists except in about 2 per cent. of the cases. But in the available data, we have found that the mother's inorganic phosphorus has never exceeded the phosphorus of the infant fontanel blood.

The cases in which the fontanel blood exceeds the cord blood in inorganic phosphorus are about equal to those in which the cord blood exceeds the fontanel blood.

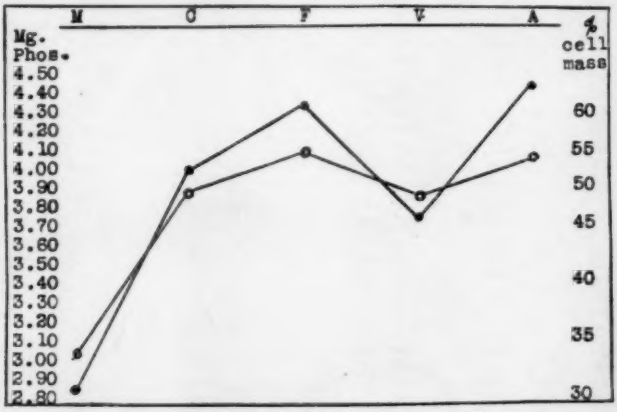
The frequency of large differences, i. e., exceeding 1 mg., is almost entirely confined to the group in which the fontanel phosphorus exceeds that of the cord.

2. Lamson, Paul D., and Nagayama, T.: J. Pharm. & Exper. Therap. **15**:331, 1920.

In the chart we have a graphic picture of the inorganic phosphorus content of the mother's blood, blood from the cord, the vein and artery of the cord, and the fontanel of the infant, in conjunction with the cell mass percentages of the same sample. The cell mass was determined by centrifuging whole blood at a definite speed for a definite period of time.

It will be seen that there is a close parallelism between the concentration of blood phosphorus and the percentage of cell mass or, wherever greater amounts of plasma are present, we may expect a lowered phosphorus concentration.

Owing to the great technical difficulty of obtaining sufficient amounts of blood from these sources to make the blood mass and inorganic phosphorus determinations simultaneously, these figures represent the complete findings in four cases.



The black dots represent inorganic phosphorus per hundred cubic centimeters. The white dots show cell mass percentage in the same specimen. The dots are connected to show the parallelism existing between phosphorus and cell mass.

In a careful search of the literature we have been unable to find any reference to similar investigations, and in the attempt to explain the differences found in the phosphorus content of the blood of the infant at different levels of the circulation, we have made recourse, first to the circulation of the fetus, and second, to the data obtained concerning cell mass percentages of the blood at the same levels.

It will be seen by referring to the circulation of the fetus that admixtures of blood take place at various points, notably: (*a*) the point of union at the inferior vena cava of blood from the liver and pure blood from the ductus venosus; (*b*) in the right auricle, the inferior vena cava blood being mixed with blood brought down from the upper extremities and skull, particularly the sinuses within the skull; (*c*) in

the placenta, in which fetal blood undergoes changes by reason of indirect contact with the maternal circulation.

It may be assumed, therefore, that the mixtures of venous and arterial blood in the circulation at various levels would tend to alter the concentration of any component of the blood.

Our second method of attempting an explanation of the differences found in the phosphorus content was through the cell mass. Lamson and Nagayama [2] in their work on blood volume speak of blood as "a fluid containing a suspension of corpuscles of constantly varying size in a fluid which is also undergoing variation in volume." They have found that in the larger vessels the average relation of red blood cell to plasma is about from 43 to 57, and that the relation of red blood cell to plasma in the smaller vessels is even less.

TABLE 3.—*Data of the Inorganic Phosphorus Determinations* *

Name	Cord Blood: Inorganic Phosphorus, Mg. per 100 C.c.	Cord Blood: Blood Count, per Cent. by Volume	Venous Blood of Cord: Inorganic Phosphorus, Mg. per 100 C.c.	Venous Blood of Cord: Blood Count, per Cent. by Volume	Arterial Blood of Cord: Inorganic Phosphorus, Mg. per 100 C.c.	Arterial Blood of Cord: Blood Count, per Cent. by Volume	Fontanel Blood: Inorganic Phosphorus, Mg. per 100 C.c.	Fontanel Blood: Blood Count, per Cent. by Volume
A. J.	4.6	52	4.0	48	5.0	61	5.0	57
J. J.	4.1	50	4.2	49	4.6	58	4.3	52
L. M.	3.9	56	3.6	55	4.5	58	3.7	49
S. A.	3.3	48	3.1	49	3.5	54	4.3	57

Blood Count per Cent. / Mg. Inorg. Phosphorus	Cord Blood	Venous Blood of Cord	Arterial Blood of Cord	Fontanel Blood	Average
	11.3	12.0	12.5	11.4	11.8
	12.2	11.7	11.5	12.1	11.9
	14.4	15.3	12.9	13.2	13.9
	14.5	14.8	15.4	13.3	14.5
Average	13.1	13.4	13.0	12.5	13.0

* The lower part of the table expresses the relation between the inorganic phosphorus and the blood cell mass. The percentage of blood cells is divided by milligrams of inorganic phosphorus per hundred cubic centimeters.

In our investigations, the relation of the size of the vessel to the cell mass is not the same as that found by Lamson and Nagayama.

We have found differences in cell mass percentages between the vein and the artery of the cord. The vein is a much larger vessel; still, in most instances, the cell mass percentage is lower. The superior longitudinal sinus is approximately equal in size to the vein of the cord, but the fontanel blood usually shows a greater percentage of cell mass.

On a purely hypothetical basis, we might assume, when the plasma content of the blood is high as compared to the cells and the phosphorus figure is low, that the plasma has undergone dilution with some non-phosphorus bearing fluid such as water.

In Table 3 the complete data of the inorganic phosphorus determinations and the cell mass percentages are given.

It is apparent that there is a parallellism between blood cell mass and inorganic phosphorus, and we may explain the differences in phosphorus at the various levels as due to an infiltration of water. If this is so, then the other blood solids would likewise be reduced, including blood cells, and no constant between them would be disturbed. In Table 3 it will be seen that if the per cent. by volume of blood cells be divided by the milligram of inorganic phosphorus (values obtained in our analysis), the quotient will be a number which should be constant, if our assumption is true. The numbers so obtained are approximately constant, the average being 13. It is to be noted that this constant is not identical for all cases. It will vary from approximately 11.5 to 14.5. But the quotient for the samples at different levels in the same infant are nearly alike, and we suspect that these constants for the infants may have a significant bearing in clinical diagnosis.

BONE CHANGES IN RICKETS

The practical application of our figures may be directed toward explaining, in part, the bone changes in rickets. Although the number of cases wherein cell mass and phosphorus determinations were made simultaneously are too few to draw any definite conclusions, it might be assumed that changes in the water component in the plasma are responsible for the differences in the phosphorus, and an infant with an increase in the water component in the blood would have a low phosphorus concentration, thus influencing adversely the reaction necessary for the deposition of tricalcium phosphate in bone. An investigation is now under way concerning the relation between the inorganic phosphorus and the water component of the blood in cases of active rickets.

The differences between artery and vein, though not large, are consistent. We have not at the present time sufficient data on the conditions prevailing in the cord and placenta to justify us in attempting an explanation. If at some time we should be in a position to offer an explanation, there are certain definite factors which must be considered. Primarily, we have the same question of the dilution as was brought out by our cell mass correlations with the phosphorus, as given in the foregoing. The structure of the cord is such as to contain far less mobile water than the placenta, and the blood circulating through the more vascular placenta may conceivably lead to a lowered concentration of the solids in the flowing blood, due to an infiltration of water. The second factor is the complex question of "selective" osmosis between the mother's and the infant's fluids in the region of the placenta. We cannot seriously consider this until we have more data concerning the composition of these fluids.

We must bear in mind that the inorganic phosphorus, though apparently the only phosphorus fraction significant in rickets, is itself a relatively minor part of the total phosphorus circulating in the blood, and that between this inorganic phosphorus and the larger organic phosphorus fraction there is an equilibrium which is constantly subjected to a disturbance. The organic phosphorus may be converted into the inorganic, or this fraction may be conjugated by organic matter and thrown into the organic fraction. This might account for the change in the phosphorus in the artery of the cord to the lessened amount in the vein. We are at present engaged in an elaborate study in which we are making phosphorus partitions of the blood taken at several levels of the infant's circulation.

CONCLUSION

In conclusion, we can definitely state that cord blood allowed to flow freely into suitable containers gives true samples of a mixture of blood from the vein and two arteries of the cord, but that these samples cannot be considered as representative of the infant's entire blood because of the apparent differences at the different levels of the circulation.

152 West Eighty-Eighth Street.

MAGNOSCOPE, AN ELECTRICAL STETHOSCOPE

FIRST REPORT *

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AND
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At the fifty-sixth regular meeting of the Tohoku Medical Society held Dec. 20, 1924, we made the first report on our electrical stethoscope which we named "magnoscope." [1] The following short excerpt from our report will show that our instrument has been developed independently of the stethophone,[2] the details of which we were only able to learn several days previous to making our report.

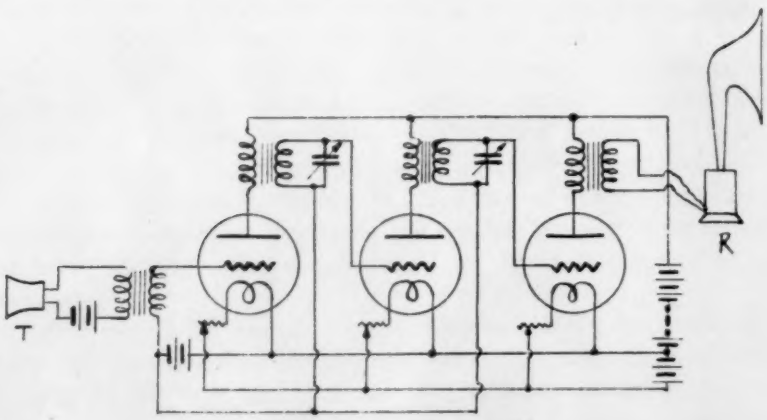

Fig. 1.—The triod valve amplifier.

Our purpose was to amplify those sounds auscultated through an ordinary stethoscope, and to reproduce them faithfully with definite filtering as a special object.

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* From the Pediatric Department of the Medical College, and the Electrical Engineering Department of the Technological College of the Tohoku Imperial University.

1. The name is a Latin-Greek alliance, but appendicitis, for instance, is preferred to scolecoiditis.

2. Frederick, H. A., and Dodge, H. F.: Bell System Technical Journal, No. 4, October, 1924.

Our method is an application of the principle of the triod valve amplifier. Our present arrangement consists of:

1. Transmitter: Telephone receiver of moving coil type specially made for magnoscope.
2. Three-stage triod value amplifier: Transformer coupling with tuning condensers.
3. Receiver: Telephone receiver of moving coil type specially made for magnoscope.

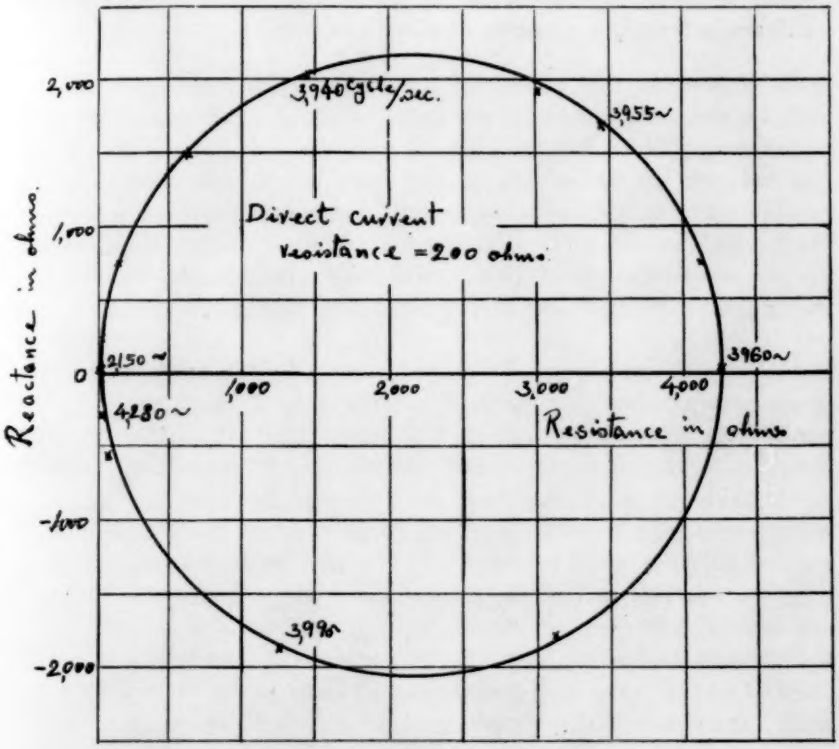

Fig. 2.—Motional impedance diagram.

After explaining the principles of the apparatus, we demonstrated the amplified heart sounds (with the aid of a loud speaker) for the audience in the large lecture hall where the meeting was held.

This arrangement (Fig. 1) has been used only for the purpose of demonstration. The microphone transmitter used in this arrangement is furnished with a rubber membrane as the vibrating system. It has a natural frequency of about 400 cycles per second. Figure 2 is the motional impedance circle [3] of the telephone receiver used in the same

3. Kennelly, A. E., and H. Nukiyama, A. E.: Electromagnetic Theory of the Telephone Receiver, A. I. E. E., March, 1919.

arrangement from which we obtain the following constants of the receiver diaphragm:

Resonance frequency = 632 cycles per second.
Damping constant = 20 second.

COMMENT

At present, we are improving both the transmitter and the receiver. So far as we know, this is the first publication regarding an electrical stethoscope from this country.

INFECTION WITH THE PLAUT-VINCENT'S FUSOSPIRILLAR ORGANISMS

REPORT OF CASES OF ACUTE LUNG ABSCESS CURED BY INTRAVENOUS INJECTIONS OF NEO-ARSPHENAMIN *

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The diagnostic "simplicitism" that frequently characterizes the diagnosis of lung abscess by those physicians who satisfy themselves with the symptoms and data afforded by physical and clinical examination alone, without considering every means of clearing the complex and often obscure etiopathogenesis of this pulmonary condition by careful and systematic laboratory findings, is deplorable. This almost always leads to serious therapeutic errors and failure, and thereby adds to the feeling of discomfort which ordinarily accompanies the prognosis of that grave disease.

The progress made by medical study of this disease within the last twenty years, guided by laboratory findings and pathologic anatomy, shows clearly that nothing would be more detrimental to the establishing of an exact therapy of lung abscess than to stop with clinical diagnosis only and with the application of those therapeutic rules, based largely on empiricism, which continue to be the bone of contention between the physician and the surgeon, each of whom wishes to establish his absolute right of action and claims every competence in this infirmity.

However, it is not my purpose to discuss here the delicate and arduous clinical and therapeutic problem of all pulmonary abscesses, as it might lead me astray from the point which I set out to prove, with the simple illustration of a case of lung abscess which was cured. Nor would it be an easy matter to establish by means of statistical reports and theoretic speculation alone what can only be decided at the bedside of the patient, namely, whether the patient is a case for the surgeon or for the physician.

I should like to show, nevertheless, that the treatment of this severe affection of the lungs seems to lead toward a plainly scientific phase, since it begins to be regulated principally by those suggestions of cleared etiopathogenesis and by those clinical deductions which arise therein.

One clinical form of lung abscess, which of late years has attracted attention because of its particular etiopathogenesis and therapy, is that

* Received for publication, Feb. 20, 1925.

brought on from infections by that special association of microbes composed of fusiform bacilli and spirochetes. This Plaut and Vincent indicated as the etiologic agent of necrotic stomatitis and angina, and established specific treatment by intravenous injections or local application of neo-arsphenamin.

However little this clinical form of pulmonary abscess differs, on the clinical side, from forms by other etiologic agents, nevertheless it is different from all others because it has in neo-arsphenamin a really specific remedy (particularly in the first stages of the disease), and consequently its prognosis becomes less serious because of greater probabilities of a definite recovery by medical treatment only.

The following clinical case, cited together with the little, although authoritative literature already written on this subject, shows the importance of an etiologic diagnosis of lung abscess for the purpose of choosing a suitable therapy.

CLINICAL REPORT

History.—J. C., a boy, aged 11 years, was admitted to the Buffalo Columbus Hospital on Aug. 25, 1924. The family and past history were unimportant.

Present Illness.—The patient had been perfectly well until about one week previous, when he began to have chills followed by rise of temperature, pain in the right side of the chest and moderately dry cough. Both the fever and the cough increased rapidly so that in a few days the boy was confined to his bed.

I had examined him two days before and made the physical diagnosis of a probable purulent lung affection, after which I advised his parents that removal to a hospital would be highly advantageous because of better facilities for treatment and proper nursing.

The symptoms at the time of admission to the hospital showed that the patient apparently was very ill and suffering considerably; he complained of severe headache and pain in the right side of the chest, which increased with coughing and breathing.

Physical Examination.—This showed that the boy was well developed and nourished. His skin was pale, warm and moist, with abnormal perspiration. The cheeks were highly colored and the eyes hollowed and glistening. The breathing was short and interrupted.

The temperature was 103.2 F.; respiration, 36; pulse, 120.

The lips were dry; the tongue also was dry and coated; the teeth were normally developed and healthy; the pharynx was somewhat inflamed, and the tonsils were a little enlarged. Acetone could be detected on the breath. The spleen and liver were normal in position and size. The bowels had been closed for about three days, and there was abdominal meteorism.

The apex beat was detected on the fourth intercostal space 2 cm. out of the mammillary line. The percussion on the precordial region showed a marked displacement of the heart to the left side; the sounds were pure on every auscultation point; the pulse was accelerated, rhythmic and equal.

The thorax was symmetrical and normally shaped; respiratory movements were diminished on the right side where the tactile vocal fremitus was increased.

Physical and Laboratory Findings.—August 26, an exploratory puncture, performed at the right subscapular region, gave exit to 15 c.c. of serofibrinous pleuritic fluid and 45 c.c. of foul green pus with an offensive odor. This pus separated into three layers in a sediment glass. Smears made by Gram's and

the Giemsa-Romanowski technic showed gram-positive cocci, fusiform bacilli and spirochetes, elastic fibers, fatty acid crystals, cast and epithelial elements. There were no acid-fast bacilli in the smears stained by Ziehl's method.

Urinalysis.—Reaction acid; color II Vogel; albumin, sugar and blood absent; acetone Legal's reaction positive; diazoreaction negative.

The sediment by centrifugalization showed sodium and potassium acid urate crystals and a few pus cells.

Blood Examination.—Leukocytes, 15,300; erythrocytes, 4,350,000; hemoglobin, 78 per cent. Differential count: neutrophil polymorphonuclears, 77 per cent.;

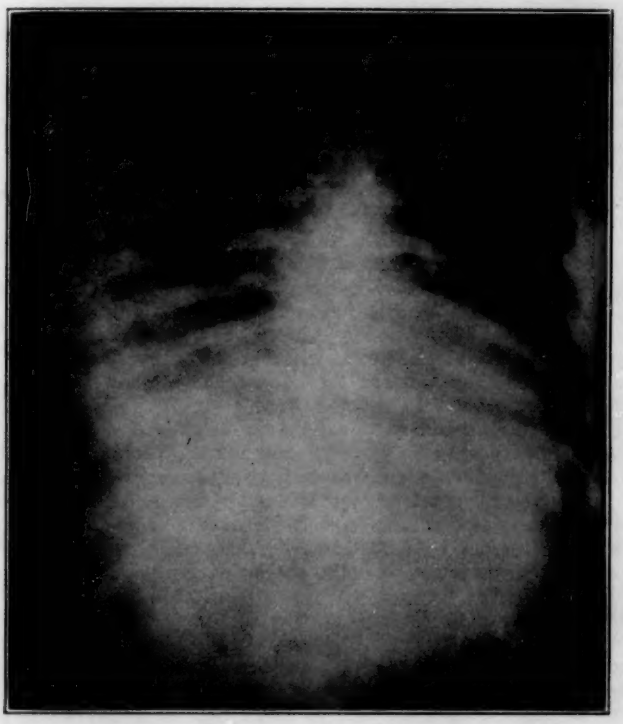

Fig. 1.—Dulness on the right subspinous and subscapular regions. Skoda's resonance evident on the right subclavicular fossa. Bronchial breathing on the region limited by fourth and ninth ribs and posterior axillary lines on the right side of the chest; small moist râles and diminution of vesicular breathing murmur anteriorly on the same side of the chest. The roentgenogram (Dr. Gianfranceschi) shows a dense shadow on the right side of the chest, extending up to the third interspace. The heart is considerably displaced to the left.

eosinophil polymorphonuclears, 1.50 per cent.; basophil polymorphonuclears, 0.50 per cent.; basotransitional, 2 per cent.; lymphocytes, 14 per cent.; large mononuclear leukoyctes, 5 per cent. The Wassermann and Pirquet tests were negative.

Progress.—August 28, temperature, 103.1 F.; respiration, 36; pulse, 120. In the last two days the cough increased and became more severely persistent and painful. At every cough onset the patient notices a foul odor to the breath. The previous night, during a severe paroxym of coughing, the patient had a

profuse expectoration of a foul, purulent liquid of the same morphologic character as the pus extracted from the chest (about 75 c.c.).

Pus expectoration continued with every cough onset, but diminished in amount; the breath of the patient was very offensive.

In the smears fusiform bacilli, spirochetes and cocci in short chains were abundant. The general condition of the patient seemed worse, and he complained of severe pain in the chest, general prostration and shortness of breath. Physical symptoms in the chest were unmodified.

Neo-arsphenamin (0.10 gm.) was administered intravenously.

August 31 the temperature was 101.9 F.; respiration, 30; pulse, 110. The general condition improved; there was moderate cough, not painful; considerable purulent expectoration (about 100 c.c. daily), but of less offensive odor. The smears showed a diminution of spirochetes, but other bacterial elements were as numerous as before.

Percussion sounds were becoming clear on the supraspinous and infrascapular regions; there were impaired resonance, amphoric breathing and numerous moist râles on the right subscapular region. There also was a soft pleural friction sound.

The patient received intravenously 0.15 gm. of neo-arsphenamin.

September 3, the temperature was 100.5 F.; respiration, 26; pulse 90. There was a notable general improvement; the cough was moderate and not painful; the sputum was much diminished in amount and was only slightly foul and in the smears revealed few spirochetes and fusiform bacilli.

Physical examination revealed a little flatness, a few inconstant râles and decreased breath sounds on the right subscapular region only.

The patient received intravenously 0.20 gm. of neo-arsphenamin.

September 6, the temperature was 99.2 F.; respiration, 24; pulse, 86. The general condition was satisfactory; the patient had a good appetite, and little cough with slight and odorless expectoration.

Smears revealed no spirochetes and only a few cocci and fusiform bacilli.

Physical pulmonary symptoms had all disappeared, except for a little flatness and a soft pleuritic friction sound on the right subscapular region.

The patient received intravenously 0.30 gm. of neo-arsphenamin.

The temperature dropped completely September 8, and has not gone above normal since. There has been no cough for about five days. Examination of the chest was totally negative, and the patient seemed clinically recovered.

September 26, the boy felt perfectly well; physical and flouroscopic examinations of the chest gave no findings worthy of notice, and the patient left the hospital.

On October 6, the boy returned for further observation. He complained of a little rise of temperature at night, pain in the right posterior side of the chest radiating to the right mammillary region and a painful unproductive cough.

The physical examination showed marked flatness, feeble breath sounds and pleuritic friction on the right lower pulmonary lobe posteriorly.

The fluoroscopic examination showed a diminution of the respiratory movements and a lessened diaphragmatic expansion in the right side of the chest. There was also a light shadow on the subscapular region.

The case was diagnosed as a dry metapneumonic pleurisy, and the patient recovered in about fifteen days.

Feb. 4, 1925, the boy was last seen; he said he had been feeling perfectly well for about three months.

COMMENT

In reviewing the medical literature of the last twenty years on the etiopathogenesis of respiratory affections, and especially those of a suppurative character, the frequency with which the fusospirillar infection is indicated as the direct etiologic agent of the illness can easily be seen.

spirillar infection is indicated as the direct etiologic agent of the illness. In fact, besides the well known oral and pharyngeal affections of a necrotic character, many cases of bronchitis, bronchopneumonia, pneumonia, abscess, gangrene and pleurisy (empyema) are reported, in which the laboratory findings show the presence of the Plaut-Vincent organisms, together with other germs usually detected in these affections.

Although Eichorst [1] had previously stated that he found spirochetes in the sputum of patients suffering from bronchitis, and Rona,[2] in two cases of pulmonary gangrene, the exact knowledge of the spirochetal infection of the bronchi and lungs began in medical literature only with the discovery of the "bronchial spirochetosis" made by Castellani [3] in Ceylon. Since that time studies on this subject have had a broad development; furthermore, accurate bacteriologic findings have led to the detection of another form of spirochetal infection of the bronchi and lungs caused by Vincent's fusospirillar association, which, unlike Castellani's bronchial spirochetosis, occurring more particularly in tropical countries, is to be found in other climates and among various races.

In fact, the occurrence of fusospirillar infection of the respiratory organs was observed in Europe and in America as well as in Africa and in Asia, and studied attentively from the clinical as well as from the therapeutic standpoint.

Shortly after the reports of Castellani on bronchial spirochetosis in Ceylon, Feldmann [4] in Hungary observed and reported many cases of pulmonary abscess and gangrene by fusiform bacillus and spirillum dentium, and Buday [5] discovered the same bacterial association in the sputum of patients with gangrenous lung, and in microscopic section of gangrenous pulmonary tissue.

In the same year Rothwell [6] in America reported some cases of bronchial Vincent's angina; a short time after, Chamberlain [7] found, in the Philippines, the fusospirillar association in some cases of pulmonary abscess and gangrene, and many authors point it out in analogous cases reported by the tropical medical press.

In Europe, followed the reports of Plaut,[8] and subsequently, little by little, the clinical and bacteriologic reports of this pulmonary infec-

1. Eichorst, cited by Fishberg and Kline: footnote 14.
2. Rona: Arch. f. Dermat. u. Syph. **74**:171-201, 1905.
3. Castellani, Aldo: Note on a Peculiar Form of Hemoptysis with Presence of Numerous Spirochetes in the Expectoration, Lancet **1**:1386, 1906.
4. Feldmann, F.: Wien. Klin. Wchnschr. **19**:695, 1906.
5. Buday, K.: Hist. Undersuch. u. d. 'Eutsthungweise der Lungengangräne, Beit. z. Path. Anat. u. z. allg. Path. **48**:700, 1910.
6. Rothwell, J. H.: Bronchial Vincent's Angina, J. A. M. A. **54**:1867 (June 4) 1910.
7. Chamberlain, W. R.: The Occurrence in the Philippines of Associated Spirochetes and Fusiform Bacilli in Lesions . . . and of the Lungs, Philippine J. Sc. **6**:487, 1911.
8. Plaut, H. C.: Deutsch. med. Wchnschr. **3**:384, 1914.

tion have become more numerous and interesting, especially during and after the World War, in American, Italian, German, French and English medical literature (Fichera,[9] Violle,[10] Barbary,[11] Thomson,[12] Mellon,[13] Fishberg and Kline,[14] Peemöller,[15] Davis and Pilot,[16] Pilot, Davis and Shapiro,[17] Kline and Blankenhorn,[18] Pilot and Davis,[19] and many others).

FREQUENCY

The most important and frequent lesions of the lungs caused by fusospirillar infection are undoubtedly abscess and gangrene. These may occur at any age and in either sex, but are found more frequently in adults (about 90 per cent.) than in children, and in men (about 70 per cent.) more than in women.

The relative rarity of the fusospirillar infection in children could be explained by the fact that predisposing causes are more numerous in the adult age than in childhood.

PREDISPOSING CAUSES

The following diseases are often cited as predisposing causes of lung abscess and gangrene by fusospirillar association: Vincent's stomatitis and angina; chronic bronchitis; pneumonia; pulmonary tuberculosis; alcoholism; cardiovascular troubles; diabetes; traumatic lung lesions; pulmonary thrombosis, and every other cause of pulmonary miopragia.

According to the majority of authorities, all these conditions would cause the migration of the fusospirillar association from the oral cavity, where it normally lives as a saprophyte, to the bronchial and alveolar epithelium.

Another predisposing cause to which some authors have given much attention of late, is the inspiration of secretion of the mouth during general anesthesia, particularly in tonsillectomy.

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9. Fichera, S.: Riforma med. **71**:1, 1918.
10. Violle, H.: Bull. Acad. de méd. Paris **79**:429, 1918.
11. Barbary, F.: Bull. Acad. de méd. Paris **79**:461, 1918.
12. Thomson, J. A.: Pulmonary Spirochetosis, Brit. M. J. **2**:775, 1919.
13. Mellon, R. R.: A Clinical and Bacteriological Study of Fusiform Bacillus Infection, New York State J. Med. **20**:187, 1920.
14. Fishberg, M., and Kline, B. S.: Spirochetal Pulmonary Gangrene, Arch. Int. Med. **27**:61 (Jan.) 1921.
15. Peemöller, F.: Deutsch. med. Wchnschr. **48**:680 (May 26) 1922.
16. Davis, D. J., and Pilot, I.: Studies in Fusiform Bacilli and Vincent's Spirochetes, J. A. M. A. **79**:944 (Sept. 16) 1922.
17. Pilot, I.; Davis, D. J., and Shapiro, I. J.: Am. Rev. Tuberc. **8**:249, 1923.
18. Kline, B. S., and Blankenhorn, M. A.: Spirochetal Pulmonary Gangrene, J. A. M. A. **81**:719 (Sept. 1) 1923.
19. Pilot, I., and Davis, D. J.: Studies in Fusiform Bacilli and Spirochetes, Arch. Int. Med. **34**:313 (Sept. 15) 1924.

Pilot and Davis [19] affirm:

> In some, even with care, a small amount may be a nucleus for a pulmonary abscess. In others a large quantity inspired is the chief factor, particularly in children who are in good health.

I agree entirely with the before-mentioned authors in the belief that the greatest number of pulmonary infections by fusospirillar association depend on migration or inspiration of fusospirillar association from a previous pathologic or saprophytic localization in the mouth or pharynx. I cannot, however, agree when they categorically affirm that "the normal lung does not harbor these organisms." [19] This absolute negation should be drawn from observation of more than fourteen healthy lungs in order to carry conviction.

From the study of this patient, I make the deduction that there may be a primitive form of pulmonary infection by fusiform bacilli and spirochetes in the same manner as any fusospirillar infection of the oral and pharyngeal cavities. The leads to the admission of the possibility, in some cases, of the presence on the bronchial and pulmonary epithelial tissue of the fusospirillar association at the saprophytic stage, in the same manner as other saprophytic bacteria have been observed to be living there.

In this case, the illness appeared acutely and without any demonstrable predisposing cause. The boy was apparently perfectly well when he felt the first symptoms of the disease. He had never had any affection of the respiratory organs. His mouth was healthy and his throat had never had any infection, except for slight colds. His teeth were healthy and strong, and without caries. His physical constitution was vigorous and in no way contaminated by hereditary illness. He had never had a general anesthesia.

How, then, can we account for the fusospirillar infection of the lung unless we admit the possibility that this bacterial association was living saprophytically in the same lung until local organic change made it pathogenic? We might thus explain all those cases of lung abscess and gangrene by fusospirillar infection in which, as in this case, there can be found no predisposing cause, nor any oral or pharyngeal focus.

Therefore, although awaiting further confirmation by more findings, I feel sufficiently authorized to assume that in some cases the fusospirillar association is present in the bronchial and in the pulmonary epithelium, where it lives saprophytically as in the oral and pharyngeal cavities.

DIAGNOSIS

In making an etiologic diagnosis of lung abscess by fusospirillar infection, the laboratory plays the most important rôle. Systematic

microscopic examinations of the sputum in every form of acute or subacute respiratory affection, particularly when the sputum is of putrid, purulent character, is absolutely essential.

The presence of fusiform bacilli with spirochetes definitely eliminates any confusion with analogous pulmonary conditions due to other spirochetal infections, such as Castellani's bronchial spirochetosis and syphilis.

The clinical differential diagnosis is the same as that of any other lung abscess.

In patients who have an unproductive cough and who present grounds for suspicion of the presence of lung abscess, I believe, contrary to the opinion of some worthy authors, that the performance of an explorative puncture of the chest is opportune, not only for clearing the physical diagnosis, but also because it is a means of freeing the patient of a considerable amount of pus.

It is understood, of course, that an explorative puncture always demands a most scrupulous asepsis, an exact localization of the purulent focus and a perfect technic.

TREATMENT

The medical treatment of abscess of the lung, as well as of other pulmonary conditions caused by fusospirillar association, must aim principally at freeing the infection focus in the lungs of these germs. For this, Ehrlich's arsphenamin therapy gives the best results in the treatment of Vincent's stomatitis and angina, and at present is used efficaciously in the fusospirillar infection of the bronchi and lungs. In 1914, in fact, Plaut [8] treated some patients with lung abscess and gangrene successfully with neo-arsphenamin, and more recently, Fishberg and Kline,[14] Kline and Blankenhorn,[18] Peemöller,[15] Pilot and Davis [19] and some others, report many recoveries and lasting improvements by the use of Ehrlich's arsenobenzolic therapy in analogous lesions of the lungs from fusospirillar association.

Almost all these authors administered the neo-arsphenamin intravenously, in progressive weekly doses as in the therapy of syphilis.

I [20] used the doses and method previously tried in the treatment of some cases of Vincent's stomatitis and angina in children, aged from 2 to 12 years. These doses are smaller than those given in the treatment of syphilis, and are administered at shorter intervals, namely, semiweekly. After the physical diagnosis by laboratory findings had been confirmed and the general condition of the patient permitted, he was

20. Spano, R. A.: Contributo statistico clinico alla terapia neoarsenobenzolica dell 'Angina di Plaut-Vincent, Pediatria, 1922.

given the first intravenous injection of neo-arsphenamin (0.10 gm.). After three days, he received a second one, of 0.15 gm.; three days later a third, of 0.20 gm. and after three more days a fourth injection of 0.30 gm. The treatment did not extend over the second week.

The results of this treatment were wholly satisfactory, and were manifest as early as after the first injection, at which time the fever became more remittent, going down to nearly normal, with elevations up to 102 F. at night only. After the third dose the temperature dropped definitely.

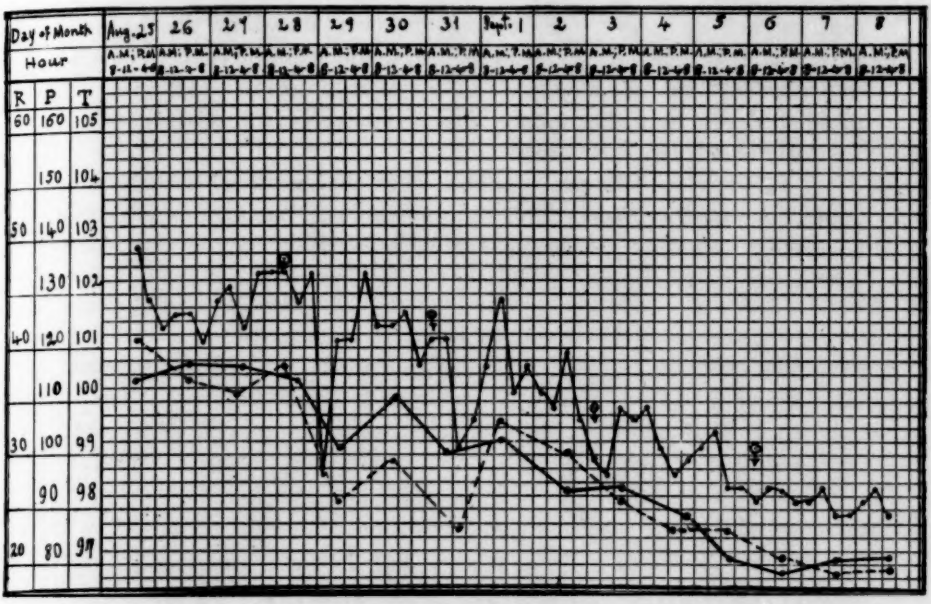

Fig. 2.—The course of the fever curve under neo-arsphenamin treatment. Temperature, straight line; pulse, broken line; respiration, heavy straight line; injections of neo-arsphenamin indicated by arrow.

The physical symptoms improved as the fever abated; a progressive diminution of the spirillar elements in the sputum was noted after the first and second injections, and after the third dose no spirochetes were detected in the sputum.

Contemporaneously with the diminution and disappearance of the spirochetes, the expectoration became more and more scant and odorless, cough rarer and less painful, and physical signs of the lung abscess progressed toward a clinical and anatomic recovery, which was complete in less than ten days from the beginning of the neo-arsphenamin treatment, and which has lasted for about four months, except for the slight pleuritic complication mentioned in the beginning of this paper.

I therefore feel sure that a rapid and decisive recovery was obtained in this patient, in whom the neo-arsphenamin was the principal therapeutic agent used.

CONCLUSIONS

1. In order to make an exact diagnosis and institute a suitable therapy for lung abscess, as well as for other lung affections (particularly those characterized by putrid expectoration), it is always safe to consider the possibility of a fusospirillary infection and to make diligent laboratory investigations.

2. In every case of lung abscess by Vincent's fusospirillary association, as well as in every other lung affection caused by this bacterial infection, it is necessary to begin the neo-arsphenamin treatment as soon as possible, and to continue it at short intervals (semiweekly), in small doses, until the decisive disappearance of the spirochetes and fusiform bacilli from the sputum.

3. It is obvious that this treatment does not absolutely exclude more radical therapeutic procedure (surgical treatment, pneumothorax) when necessary. However, it should not be interrupted by the surgical or pneumothorax treatment, but should be combined with it.

LYMPHATIC LEUKEMIA WITH LEUKOPENIA IN YOUNG CHILDREN *

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REVIEW OF THE LITERATURE

Previous to the description by Morse,[1] in 1898, there is but little reference in the literature regarding those primary blood diseases in children which are now recognized as leukemia. Morse was able to find only seven. Churchill,[2] even as late as 1904, collected only twenty-two cases, including the seven reported by Morse. Analysis of these early cases shows that little attempt was made to classify them into the groups which are now authentically established. As the result of increasing knowledge and steady improvement in the technic of routine blood examination, the number of cases reported has materially increased until leukemia is no longer considered a rare disease in children. In 1910, Ribadeau-Dumas and Boudet [3] reported a series of 100 cases of acute leukemia, nineteen of which were in children. In 1922, Morse [4] reported thirty-seven cases of severe anemia which he had seen in private practice and at the Children's Hospital. Thirteen of these were diagnosed as leukemia, while at least ten more might well have fallen within this group if more data had been available. Since 1922, three more authentic cases of leukemia as well as three doubtful cases have been seen in the Children's Hospital.

The leukemias have been divided into two groups: the lymphatic and the myelogenous. Each of these groups is often subdivided into "acute" and "chronic." It is only within comparatively recent years, however, that cases with a low white blood count (leukopenia), instead of the usual high count (leukocytosis), have been recognized as an essential part of the whole group of leukemias. Such cases have been referred to as "aleukemic leukemia." Churchill,[2] in 1904, pointed out the terminal drop in the leukocytes in his case of leukemia. He suggested the possi-

* Received for publication, March 4, 1925.

* From the Pediatric Department, Harvard Medical School, and the Children's Hospital.

1. Morse, J. L.: Acute Leukemia in Childhood, Arch. Pediat. **15**:330 (July) 1898.

2. Churchill, F. S.: Acute Leukemia in Early Life, Am. J. M. Sc. **128**: 563-582 (Oct.) 1904.

3. Ribadeau-Dumas and Boudet: Note sur l'etat du foie dans la leucemie aigué, Bull. et mém. Soc. anat. de Paris **85**:235-237, 1910.

4. Morse, J. L.: Leukemia and Severe Anemia in Childhood, Boston M. & S. J. **186**:507-513 (April 13) 1922.

bility of persistently low white blood counts in true leukemia. In 1909, Barker [5] presented a case of unusual anemia in a child, which corresponded closely to more recently reported cases of aleukemic leukemia. Ross,[6] in 1915, reported three cases of aleukemic leukemia which he considered myeloid in type. One of these was quite similar to the two cases in this report. Three of the eleven cases of leukemia in children reported by Litchfield,[7] in 1921, showed leukopenia. Since then there have been a number of similar cases reported, including four in Morse's series of anemias,[4] one by Upjohn and Graham,[8] and three by Baar.[9] Baar's article includes not only an exhaustive discussion of the subject but also a very complete bibliography.

DEFINITION OF LEUKEMIA

The purpose of this paper is to place on record two cases of lymphatic leukemia which showed leukopenia instead of leukocytosis. In the literature, such cases have been grouped under various titles, of which "aleukemic leukemia" has been the most generally accepted term. The word "leukemia" (white blood or, less literally, an increase in the white elements of the blood) is a misnomer in describing a disease in which there is no increase in the number of white cells in the blood stream. But in view of our greater knowledge of the disease, in recent years, leukemia might be defined as a disease of that portion of the hematopoietic system which produces the white blood cells. If such a definition is acceptable, then the name "aleukemic leukemia" becomes quite misleading, for even with a low white blood count there are always some leukocytes in the blood which are characteristic of leukemia. For this reason, the term "aleukemic leukemia" has been purposely avoided in this paper.

REPORT OF CASES

CASE 1.—*History.*—V. L., a boy, aged 4 years, was admitted to the Children's Hospital, June 19, 1924. The chief complaint was pallor and weakness of eight months' duration. The patient had always been regarded as a normal, healthy boy until 3 years of age, when he developed pertussis (one year before his admission to hospital). He was sick for about three months with severe paroxysmal attacks of coughing and vomiting. He also had retinal hemorrhages at this time. Eight months before his admission, the parents noticed that he was

5. Barker, W. W.: Fatal Anemia of Unknown Cause in a Child of Five Years, with Unusual Cells in the Blood, Am. J. M. Sc. **138**:96-99 (July) 1909.

6. Ross, A.: A Note on Three Cases of Acute Myeloid Leukemia, Lancet **2**:940-942 (Dec. 2) 1916.

7. Litchfield, W. F.: Series of Primary Anemia in Children, M. J. Australia **1**:231 (March 19) 1921.

8. Upjohn, W. D., and Graham, H. B.: Leukemia in Childhood, M. J. Australia **2**:585-587 (Nov. 18) 1922.

9. Baar, H.: Ueber akute aleukozytämische Leukämie im Kindesalter, Jahrb. f. Kinderh. **104**:1-32 (Jan.) 1924.

becoming pale and weak, although his convalescence from pertussis had seemed satisfactory previous to this time. During the two months previous to admission, the pallor and weakness became very pronounced. In addition, it was observed that (1) there were swellings in the neck and groins which increased steadily in size; (2) the abdomen was becoming more and more prominent; (3) the patient frequently complained of abdominal distress; (4) there was steady loss of weight and strength, and (5) the patient became increasingly irritable and complained of generalized tenderness.

Fig. 1.—This picture shows the peculiar pallor and facies described in the physical examination, the lymph node enlargement, and the outline of the enormous spleen, at the close of the first phase of the patient's course.

Physical Examination.—On admission, the patient was a well developed and fairly well nourished white boy. He was apathetic but very irritable when disturbed. Certain other points in the general appearance are worth noting since they suggested the diagnosis. His face was well rounded and plump.

There was definite puffiness about the eyes. His color was a peculiar pallor, grayish about the orbits and malar prominences but waxen elsewhere (Fig. 1). In the facies there was that combination of apathy and anxiety which one often sees in malignancy. The other positive findings were: (1) a small purpuric spot below the right eye; (2) marked enlargement of all the superficial lymph nodes, which ranged in size from 0.5 to 2.0 cm.; (3) a very prominent abdomen in which the liver edge was palpated 6 cm. below the costal margin on the right, and an enormous, firm spleen almost filled the left side of the abdomen, extending to the midline and almost to the iliac crest; (4) slight tenderness over the long bones of both legs. Otherwise the physical examination was essentially normal.

Laboratory Data.—On admission, the erythrocytes were 1,200,000 per cubic millimeter. The hemoglobin (Sahli) was 20 per cent. The leukocytes were 1,800 per cubic millimeter. The differential count showed: polymorphonuclear forms, 26 per cent.; large lymphocytes, 33 per cent.; small lymphocytes, 25 per cent.; unclassified forms, 16 per cent. In counting 100 white cells, 3 nucleated red corpuscles were seen. The platelets were 30,000 per cubic millimeter. The bleeding time was four minutes (vigorous needle prick in the ear lobe); the clotting time was one and one-half minutes (capillary tube method[10]). The red blood corpuscles showed marked variation in size, shape and standing. The large lymphocytes were mostly of the large immature type seen in the usual case of acute lymphatic leukemia (Fig. 2). The abnormal leukocytes (16 per cent.) could not be classified in any known group, although many of them may have been very immature cells of the lymphocytic series. In later smears, occasional myelocytes were also seen (Fig. 3). The small lymphocytes and polymorphonuclear forms were relatively normal. Smudges (fragmented cells) were quite numerous, even on carefully made coverslip preparations. The oxidase reaction showed no granules in the mononuclear cells.

The blood Wassermann reaction and the intradermal tuberculin test were negative. All other laboratory data were also essentially negative.

Course of Illness.—The disease ran a subacute course of three months' duration before death intervened. For convenience of description this has been divided into four phases:

1. First Remission: During the first three weeks the child showed slow but steady improvement. He became bright, happy, and strong enough to sit up and play with his toys. The erythrocytes increased to 2,000,000 per cubic millimeter, the leukocytes to 5,000, and the platelets to 40,000 per cubic millimeter. The blood smears showed fewer abnormal leukocytes, while the lymphocytes increased to 80 per cent.

2. First Relapse: From the third to the seventh week he steadily became worse. This period was characterized by increasing weakness, pallor, anorexia and irritability, followed by epistaxis, purpura, and, finally, the development of an abscess in the left cervical region. The patient had an irregular fever during the whole of this period. The spleen and lymph nodes increased steadily in size. During the fourth week of illness, the patient was transfused with 250 c.c. of citrated whole blood. There was no untoward reaction but it failed to check the downward course. Two weeks later the erythrocytes had fallen to 872,000 per cubic millimeter, and the leukocytes to 720 per cubic millimeter (Fig. 4). During the last few days of this phase, immediately before and after the drainage of the abscess, his condition was critical. His heart action was weak, his respirations rapid and shallow, and an immediately bad prognosis was given to his parents.

3. Second Remission: For three weeks following the draining of the abscess, the improvement was little short of miraculous. He again became able to

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10. Mills, C. A., and Petersen, M. F.: A New Method for Accurately Determining the Clotting Time of the Blood, Arch. Int. Med. **32**:188-191 (Aug.) 1923.

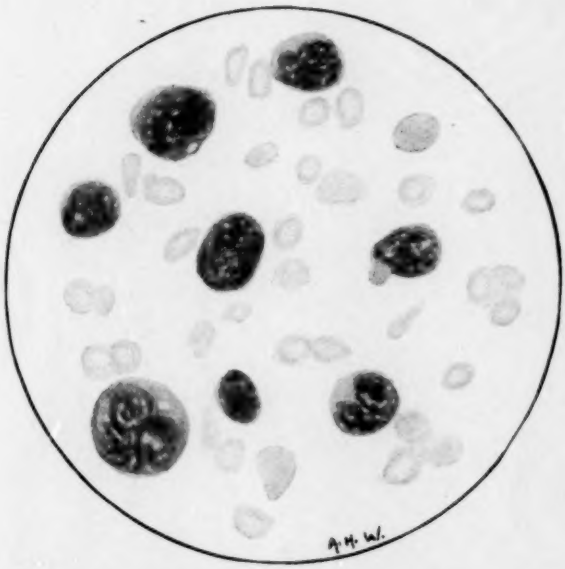

Fig. 2.—A group of those large immature lymphocytes, referred to as typical of acute lymphatic leukemia. These cells were from two adjacent fields.

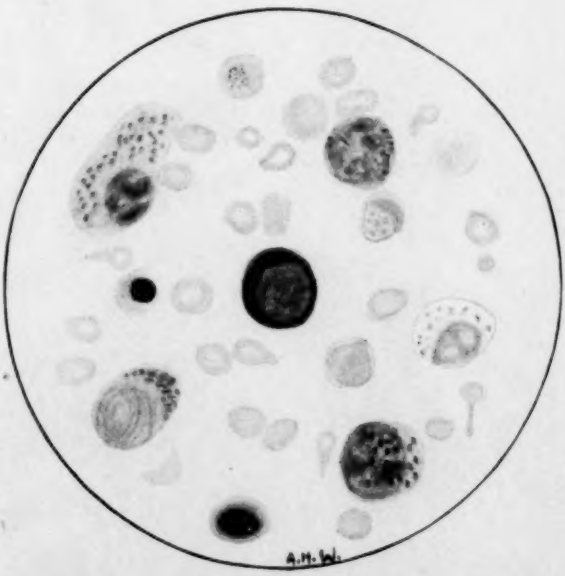

Fig. 3.—A group of abnormal leukocytes, collected from various parts of one smear. Note also the unusual degree of variation in the red blood cells.

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stand up in his crib, play and laugh. The diminution in the size of the spleen during this period was striking, the lower pole being as far down as the iliac crest and the right border extending well into the right side of the abdomen at the start of this phase. After two and one-half weeks, the spleen was entirely in the left upper quadrant; the erythrocytes rose to 2,000,000 per cubic millimeter again; the platelets remained between 20,000 and 30,000 per cubic millimeter, and the leukocytes reached 22,000, the only count during his entire course in the hospital which showed a leukocytosis (Fig. 4), although the leukocytes were counted twenty-four times. The smear on this occasion was the only one which presented the typical appearance of an acute lymphatic leukemia. The differential count showed 90 per cent. lymphocytes, most of which were of the immature type shown in Figure 2.

4. Second Relapse with Termination: This period of three weeks was marked by steady loss of strength, increasing pallor and irritability, and irregular fever (of the type which is commonly associated with sepsis), enlarging spleen and lymph nodes, recurrent epistaxis, and marked tenderness

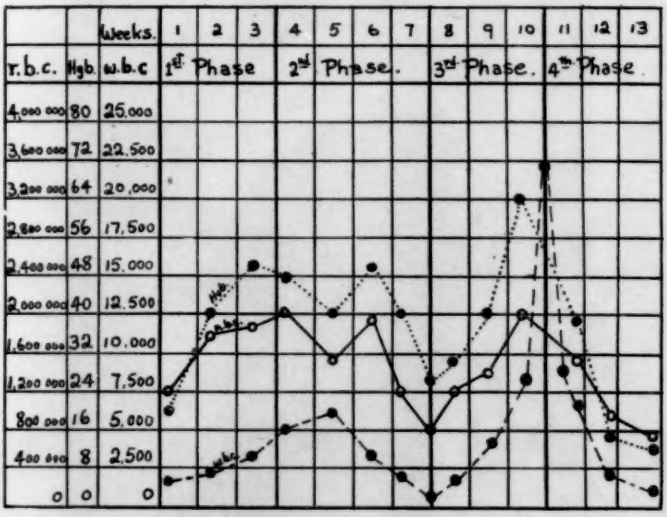

Fig. 4 (Case 1).—The weekly variations in the blood counts are seen to correspond, in general, to the clinical changes during the four phases of the patient's course in the hospital.

over the long bones and lymph glands. The erythrocytes fell to 708,000 per cubic millimeter, and the leukocytes to 1,300 per cubic millimeter. There was marked dyspnea during the forty-eight hours previous to his death, on Sept. 18, 1924, eleven months after the onset of pallor.

Diagnosis.—On admission, the general appearance of the patient, the enlargement of the spleen and lymph glands, the marked anemia (apparently primary), and the low platelet count seemed to point toward the diagnosis of leukemia. As evidence against this diagnosis were the following points: the periods of clinical improvement, especially following the draining of the cervical abscess; the persistent leukopenia, and the atypical blood picture. These features made it necessary to keep in mind those unusual forms of anemia in children which are apparently due to infection with one of the pyogenic organisms. But the fact that no other focus of infection was found except the abscess, which was of comparatively short duration, seemed to furnish further evidence in favor of the

diagnosis of leukemia. A thorough study of all the blood smears was also of great help in arriving at the final clinical diagnosis of lymphatic leukemia. The necropsy report bears out this diagnosis, as shown by the following protocol.

Pathologic Report.—A complete necropsy was performed on September 18, eight hours postmortem. The essential findings are shown by the following pathologic diagnoses: (1) Anatomic: leukemia, splenomegaly (498 gm.),

Fig. 5.—This picture was taken about four weeks before death. Note the masses of petechiae about the face and in each groin.

hyperplasia of all the lymph nodes, enlarged liver (868 gm.), anemia, hematoperitoneum, hematothora.., (2) microscopic: lymphatic leukemia, infiltration of epicardium, lungs, spleen, liver, intestinal walls, pancreas, kidneys, suprarenals, bladder and bone-marrow, pulmonary infarcts, hyperplasia of the lymph nodes, and hemorrhages into the myocardium, kidneys and bladder. Examination of the spleen showed that the malpighian corpuscles were either reduced in size

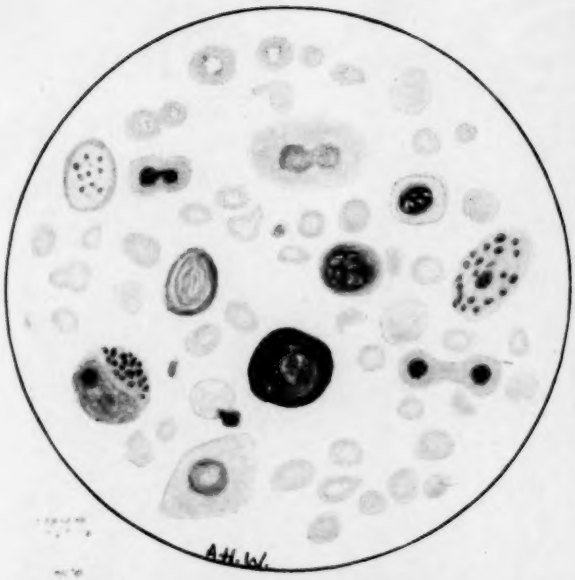

Fig. 6.—A group of atypical leukocytes collected from various parts of one smear. Note the unusual forms of red blood cells, including one which is apparently dividing.

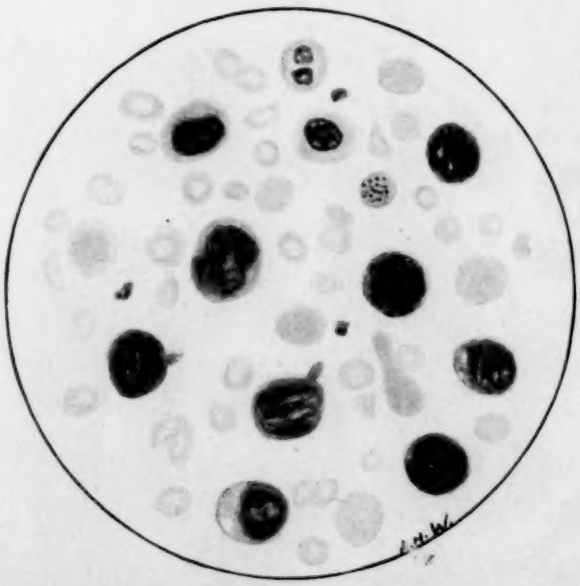

Fig. 7.—A group of large lymphocytes, collected from various parts of one smear. Such extreme variations in the red blood cells were present in nearly every smear examined.

or indistinct, while the surrounding pulp was heavily infiltrated with numberless cells of the mononuclear type seen in the lymph nodes. There were extensive hemorrhages into the pulp areas and a diffuse increase in the connective tissue. The lymph nodes showed that the germinal centers and normal structure were absent, while there was a diffuse distribution of mononuclear cells. These cells were moderate in size, with a nongranular cytoplasm and hyperchromatic nucleus. The peripheral sinuses were intact and filled with cells which were, presumably, lymphocytes. The medullary cord was thickened with the same cells. Sections of blood clots showed an abundance of similar mononuclear forms. (Tissue sections were all seen by Dr. S. B. Wolbach.)

Case 2.—*History.*—J. M., a boy, aged 2 years, was admitted to the Children's Hospital on Aug. 4, 1924. The chief complaint was swelling of the neck glands, associated with hoarseness, of one week's duration. The past history was negative except for an attack of measles with bronchitis one year before admission. The present illness started with a cold, which the child contracted one week before admission. When the neck glands became swollen and hoarseness developed, the child was sent to the Boston City Hospital with the tentative diagnosis of diphtheria. At that time the blood examination showed 34,000 leukocytes per cubic millimeter, of which 85 per cent. were lymphocytes. On this finding the diagnosis of leukemia was made. The patient was taken home but became worse. During the five days previous to his admission to the Children's Hospital, the enlarged cervical nodes had persisted but the parents had not noticed any other symptoms except hoarseness and general malaise.

Physical Examination.—On admission, the patient was a well developed and nourished white boy. He was slightly pale, very irritable, and looked acutely ill although his temperature was only 100 F. The only positive findings were: (1) slight pallor of the skin without petechiae or purpura; (2) enlargement of the tonsils without evidence of infection; (3) moderate enlargement of the cervical lymph nodes, which measured from 0.2 to 1.0 cm. in diameter, and slight enlargement of all the superficial lymph nodes; (4) slight prominence of the abdomen which was held firmly and was definitely tender; the liver edge was felt 6 cm. below the right costal margin; the spleen extended to a point just below the level of the umbilicus; (5) the reflexes were slightly hyperactive. Otherwise the physical examination was essentially normal.

Laboratory Data.—On admission, the erythrocytes were 4,304,000 per cubic millimeter. The hemoglobin (Sahli) was 72 per cent. The leukocytes were 11,200 per cubic millimeter. The differential count showed: polymorphonuclear forms, 32 per cent.; large lymphocytes, 31 per cent.; small lymphocytes, 30 per cent.; unclassified forms, 7 per cent. The platelets were 30,000 per cubic millimeter. Ten nucleated red corpuscles were seen in counting 100 white cells. (All nucleated red blood cells seen were polychromatophylic.) The bleeding time was from twelve to fifteen minutes (vigorous needle-prick in the lobe of the ear). The clotting time, one minute (capillary tube method[10]). There were great variations in the size and shape of the red corpuscles, with an unusual degree of polychromatophilia; also many bizarre leukocytes. Some of these may well have been abnormal types of immature lymphocytes, but many of them defied any classification (Fig. 6). About 15 per cent. of the large lymphocytes were of the large immature type already referred to in the first patient (Figs. 2 and 7). The other lymphocytes and the polymorphonuclear forms were relatively normal. The oxidase reaction showed that there were no granules in the mononuclear cells.

The blood Wassermann reaction and the intradermal tuberculin test were negative. All other laboratory data were also essentially negative.

Course of Illness.—The disease ran a subacute course of twelve weeks' duration. During the first three weeks of observation the patient's condition remained unchanged. The leukocytes, after falling to 6,700 per cubic millimeter, rose to 16,000, while the erythrocytes dropped to 3,300,000 per cubic

millimeter. (See Figure 8 for the variations in the blood counts during his hospital course.) The smears continued to show from 50 per cent. to 80 per cent. lymphocytes and from 7 per cent. to 12 per cent. unclassified forms. Occasional myelocytes were also seen (Fig. 6). An exposure to radium was given on August 16 at the Collis P. Huntington Memorial Hospital. No effect was noted from this treatment except for a very slight and transient reduction in the size of the spleen. Three and a half weeks after admission, the child became sudenly worse, with marked increase in weakness and pallor. During this period there were occasional showers of petechiae. Previous to this time he had shown only transient rises in temperature at irregular intervals, but from then until his death, eight weeks later, the patient showed an irregular fever (of the type commonly associated with sepsis), often with sudden rises in temperature to 103 F. During the last eight weeks, the course was one of slow but steady decline. He had two more showers of petechiae (Fig. 5), occasional purpura, and steadily increasing spleen and lymph nodes. In spite of some variation in the blood counts their trend was downward (Fig. 8). On

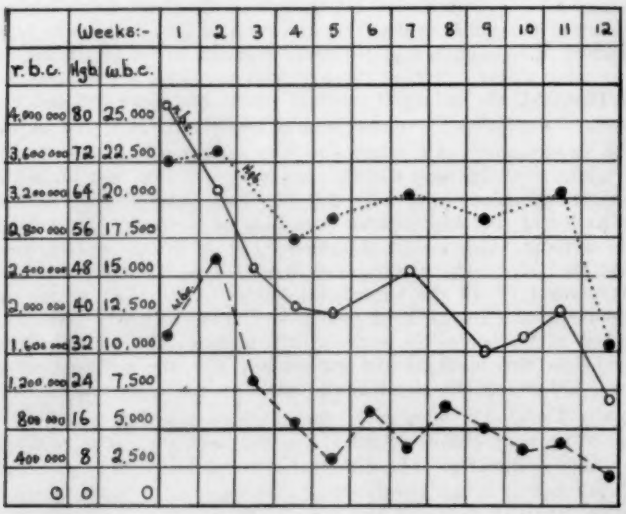

Fig. 8 (Case 2).—The weekly variations in the blood counts show that the most marked drops were in the first four and the last weeks.

October 27, the day of his death, the erythrocytes had reached 1,124,000 per cubic millimeter; the leukocytes, 2,350, and the platelets were too few to count. During the last eight weeks the white count was never over 5,000 per cubic millimeter, and the smears continued to show over 50 per cent. lymphocytes with many abnormal forms. At no time did the smears look typical of those seen in the usual case of lymphatic leukemia, although some typical cells could always be found (Fig. 7).

Diagnosis.—On admission, the enlarged spleen and lymph nodes, together with the report of the white blood count, made one week previously at the City Hospital, and the low platelet count, were the only points which seemed to favor the diagnosis of leukemia. The relatively high red blood count, with a relatively low white blood count, together with so brief a history, were features which made it imperative to bear in mind those unusual anemias in children which are dependent on some focus of infection. But repeated examinations failed to show any such focus. A lymph gland, excised from the scalp, was reported

as "consistent with lymphatic leukemia" by Dr. Wolbach. During the last few weeks of the patient's life, the general appearance became much more characteristic of leukemia. He developed the same puffiness about the eyes, associated with the same peculiar grayish pallor described in the first patient. This general appearance, the steadily downward course, the appearance of petechiae and purpura, and the careful examination of twenty-five blood smears led to the final clinical diagnosis of lymphatic leukemia. No necropsy was performed.

COMMENT

These two cases of leukemia, similar in many aspects but quite different in others, present certain points of especial interest.

1. *Onset.*—In the first patient the onset was insidious, with pallor and weakness as the only early symptoms, while the enlarging glands and abdomen were not noticed until several months after the onset. In the second patient it was the enlargement of the cervical glands, associated with irritability, which drew attention to the disease, while the red blood count was still nearly normal.

2. *Etiology.*—In both patients there was an irregular fever during the greater part of their stay. In the first, the abscess of the cervical gland was of short duration and therefore of no apparent significance as a causative factor in the disease. In the second patient, no focus of infection was found at any time. Wassermann reactions, tuberculin tests, blood cultures, etc., were all negative and no data can be presented from either case which adds anything to our knowledge of the cause of leukemia.

3. *Course.*—The relative chronicity of the course of the disease is a striking feature when compared with the usually acute course of lymphatic leukemia in young children. It is interesting to note, in this connection, that one of Baar's [9] patients with "aleukocytic leukemia" lived one year after the diagnosis was established.

4. *Physical Findings.*—The lymph node enlargement, associated with large liver and spleen, was common to both patients, but much more marked in the first, whose course was the more chronic. The variation in the size of the spleen in the first patient was an unusual finding, which not only cast some doubt on the correctness of the diagnosis but also gave false hopes of a more favorable prognosis, for, with the accompanying clinical improvement, it was felt that we might be dealing with an anemia secondary to some hidden focus of infection. Greenthal [11] and Ward [12] discuss the difficulty of differentiating between certain cases of leukemia and other severe anemias in children.

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11. Greenthal, R. M.: Aleukemic Leukemia, Clinically Resembling Von Jaksch's Anemia, J. Mich. M. S. **20**:86 (March) 1921.

12. Ward, A.: Von Jaksch's Disease, Brit. J. Child. Dis. **15**:101 (April-June) 1918; ibid. **17**:18 (Jan.-March) 1920.

5. *Treatment.*—Neither the transfusion in the first nor the radium therapy in the second patient seemed to have any effect on the course of the disease. The only other treatment given was purely symptomatic.

6. *The Blood Picture.*—The association of a diminished number of circulating leukocytes with such marked hypertrophy of the lymph tissue was striking in both patients, but more so in the first. During the greater part of his course there was an actual decrease in the total number of lymphocytes—a fact even more striking when one considers the extensive infiltration of the bone marrow and other tissues which was shown at necropsy. In fact, it was often difficult, in either patient, to coordinate the blood picture with the possible pathologic processes in the hematopoietic system. In the first patient there was less evidence of reproduction of bone-marrow cells, the fluctuations in the erythrocytes and the leukocytes of bone-marrow origin being closely parallel. But the sudden increases in these elements were as surprising as were the clinical remissions. In the second patient, while both the total number of red corpuscles and the proportion of immature forms decreased steadily as the disease progressed, there was an unexplained variation in the percentage of those leukocytes which were obviously of bone-marrow origin. But in spite of the unusual aspects of these blood pictures, it may be pointed out that both were alike in showing, usually, a preponderance of lymphocytic forms with from 10 per cent. to 25 per cent. of those large immature lymphocytes seen so commonly in acute lymphatic leukemia (Figs. 2 and 7). It was also true in both patients that evidences of bone-marrow activity diminished as the disease progressed, while the tendency to bleeding increased at the same time. Frequent and thorough studies of the blood smears from week to week and, sometimes, from day to day, were of greater value in these cases than the blood counts, which usually mean so much in the diagnosis of leukemia.

SUMMARY

A brief review of the literature shows the increasing frequency with which cases of leukemia in children are being recognized. In spite of this increase, the number of reported cases of so-called aleukemic leukemia is still small.

Two cases of lymphatic leukemia are reported which presented certain unusual features. The course in each case was unusually chronic. The first patient also showed two definite remissions, while under observation. The blood, in both patients, was characterized by a persistent leukopenia, with many atypical cells in the blood smears.

The diagnosis was supported in the first patient by the necropsy findings and in the second by the biopsy report.

Attention is called to the importance of frequent and thorough studies of the blood.

THE KIDNEY: A FILTER FOR BACTERIA

III. THE RÔLE OF TECHNIC ON THE APPARENT EXCRETION OF BACTERIA BY THE KIDNEY *

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One of the outstanding features of the work on excretion of bacteria by the kidney is the relationship of the technic employed to the results obtained. The use of the catheter or of methods of securing the urine other than by sterilization of the bladder wall and by direct puncture has given results that are at variance with those in which there was no instrumentation. The work of Rolly, and particularly of Biedl and Kraus, is constantly quoted when the passage of bacteria through the normal kidney is discussed. Their technic is definitely open to criticism, in that both series of experiments were carried on either with the catheter tied into the ureter, or by obtaining the urine by catheter from the bladder.

RESULTS

The uniformly negative results which we obtained in all of our experiments in contradistinction to those of the before-mentioned observers led us to repeat the experiments on diuresis, using repeated catheterization or the inlying catheter to collect our specimens of urine, instead of the standard technic of searing the bladder and perforating the wall with a sterile pipet.

BACTERIOLOGY

In our first series of thirteen experiments, nine were done with the staphylococcus, and four with *Bacillus coli*. These experiments cover a period of three hours, specimens being taken at the end of the first, second, and third hours. One cubic centimeter of urine was cultured in duplicate, in liquid and in solid mediums, and the remainder of the specimen incubated for twenty-four hours. As will be seen from Table 1, some of the experiments covered only two hours, and in three instances specimens were not taken until the end of the second hour. In six of the thirteen experiments, bacteria were found in the urine: twice at the end of one hour, once at the end of two hours, and twice at the end of three hours. In the sixth instance, the specimen remaining after the inoculation

* Received for publication, Feb. 3, 1925.

TABLE 1.—*Experiments with Inlying Catheter or Repeated Catheterization*

Rabbit	10 per Cent. Glucose Injected Intravenously, C.c.	Organism Injected 5 Minutes After Starting Glucose Solution	Culture of Urine: First Hr.	Culture of Urine: Second Hr.	Culture of Urine: Third Hr.	Solid Mediums in Duplicate, 1 C.c.	Liquid Mediums in Duplicate, 1 C.c.	Remainder of Specimen	Remarks
527	100	Staphylococcus	..	0	..	0	0	—	
529	70	Staphylococcus	..	0	..	0	0	—	
530	50	Staphylococcus	..	0	..	0	0	0	
533	80	Staphylococcus	0	0	..	0	0	—	Died at end of second hour
534	50	Staphylococcus	0	0	0	0	0	0 0 0	
515	...	Staphylococcus	0	0	+	..	..	..	
514	...	Staphylococcus	0	0	+	..	..	..	
513	...	Staphylococcus	+	+	+	..	..	..	Inlying catheter
512	...	Staphylococcus	0	0	..	..	..	..	Sacrificed at end of second hour
531	100	Bacillus coli....	0	0	0	0	0	0 + 0	
532	100	Bacillus coli....	0	0	0	0	0	0 0 0	
506	25	Bacillus coli....	0	+	..	..	..	..	
507	...	Bacillus coli....	+	+	..	..	..	..	

was incubated and showed numerous staphylococci. Bacteria were present in the large amount, but not in four separate inoculations of 1 c.c. in liquid and solid mediums. In two of three experiments in which all of the urine passed in three hours was incubated, all of the tubes were sterile, and only in the balance of the specimens taken after the second hour was there growth. In these experiments, about 50 per cent. of the urine specimens did not contain bacteria.

RESULTS IN SECOND SERIES

In the second series of experiments in which a maximal diuresis was achieved, the results are comparable. The specimens were taken at fifteen-minute intervals up to the end of the first hour. In these experiments *Bacillus coli* and *Staphylococcus aureus* were used in six instances each. In all the experiments 20 per cent. sucrose solution was injected intravenously, and in three, physiologic sodium chlorid solution was also given. The amounts obtained at the fifteen-minute intervals are seen in Table 2. In only one animal, Rabbit 659, was there any blood in the urine, and that at the end of the hour, but no bacteria were present on culture. In four of the twelve experiments, bacteria were found in the fifteen, thirty, forty-five and sixty-minute specimens: after fifteen and thirty minutes there were bacteria in one experiment, but not after forty-five and sixty minutes; in another the bacteria were present after fifteen, thirty and forty-five minutes, but not after sixty minutes. As indicated in the table, in Rabbit 650 there were many bacteria in all four specimens, and then the cultures became sterile. In

TABLE 2.—*Experiment with Inlying Catheter Showing Relation of Maximal Diuresis to Passage of Bacteria* *

Rabbit	20 per Cent. Sucrose or Glucose Injected, C.c.	Physiologic Sodium Chlorid Solution Injected, C.c.	Organism Injected 20 Minutes After Starting Sucrose	Urine Passed in C.c. Before and After Injection of Bacteria					Culture of Urine Using 10 C.c. During					Diuresis for Each Kilogram for Each Hour
				5 Minutes Before	15 Minutes After	30 Minutes After	45 Minutes After	60 Minutes After	5 Minute Preliminary Period	15 Minute Period	30 Minute Period	45 Minute Period	60 Minute Period	
649	200	0	Bacillus coli.....	100	80	34	37	75	0	0	0	0	0	181
650	325	0	Bacillus coli.....	30	100	50	100	110	0	+	++	+	++++	180
658	450	0	Bacillus coli.....	25	37	42	..	..	0	++++	++++	+++	+++	75
659	190	100	Bacillus coli.....	180	50	30	13	10	0	0	0	0	0	56
660	225	70	Bacillus coli.....	50	80	90	36	10	0	++	++++	0	0	140
638	185	55	Staphylococcus...	..	25	85	80	80	..	+	−	++	0	135
640	200	0	Staphylococcus...	..	64	24	22	3	..	+	+	+	+	91
641	110	0	Staphylococcus...	..	87	45	5	1	..	+	+	+	+	138
642	220	0	Staphylococcus...	..	100	90	24	1	..	0	0	0	0	139
643	110	0	Staphylococcus...	..	68	10	55	13	..	0	0	0	0	81
644	150	0	Staphylococcus...	..	80	50	15	5	..	0	0	0	0	120

* Bacillus coli present in all cultures of blood at necropsy. Ten per cent. sucrose used. Tests for blood in urine negative except in Rabbit 659 at end of 60 minutes. Staphylococcus present in all cultures of blood at necropsy.

Rabbit 649 there was a gradual increase in the number of bacteria. In the others, only a small number of bacteria were found throughout the experiment.

Here, too, with a diuresis up to 180 c.c. for each kilogram of body weight each hour, bacteria were found in the urine in only one half of the cases. In 50 per cent. of the animals, no bacteria were excreted in the urine in spite of the diuresis and the technic employed.

DIFFERENCE IN RESULTS

The differences between the results of the two technics are perhaps seen best by a comparison of the total experiments with each method. As seen in Table 3, when the urine was obtained from the bladder by catheterization, bacteria were found in the urine in 50 per cent. of the

TABLE 3.—*Influence of Technic on Excretion of Bacteria Through Kidney*

	Urine Obtained by Catheter from Bladder	Urine Obtained by Puncture of Cauterized Bladder at Necropsy
Number of experiments	24	56
Bacteria in urine	12	1*
Urine sterile	12	55
Percentage positive	50	2*

* Ten c.c. and 5 c.c. of urine sterile on litmus lactose plate. Five c.c. urine positive in dextrose brain broth.

cases. If urine was obtained through the seared bladder wall with a sterile pipet, they were found in only a possible 2 per cent. The fact that the single case in which bacteria were found had no bacteria in two cultures using 15 c.c. of urine, although they were present in a liquid culture made with 5 c.c., all taken from the same container, shows that if contamination did not account for the presence of the organism only very few bacteria could have been present.

SUMMARY

Technic plays an important rôle in the determination of the excretion of bacteria by the kidney. Urine obtained by the use of the catheter contains bacteria in almost 50 per cent. of the instances. Even with this possible error in technic, bacteria do not constantly appear in the urine with marked diuresis.

THE KIDNEY: A FILTER FOR BACTERIA

IV. THE EFFECT OF CLAMPING THE RENAL ARTERY OR RENAL VEIN ON THE PASSAGE OF BACTERIA INTO THE URINE *

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The negative results obtained in previous experiments in attempting to force bacteria through the kidney by diuresis led us to investigate further the powers of the kidney to hold back bacteria when subjected to various injuries. In this series of experiments, the left renal artery or vein was clamped for varying periods of time and at the same time the right ureter was tied, so that no urine could reach the bladder from the normal kidney. The bladder urine was always tested for sugar, to make sure that there had actually been a secretion of urine from the injured kidney. To insure a secretion of urine whenever possible, a 20 per cent. sucrose solution was injected intravenously. The tremendous diuretic effect of the sucrose is best seen in the markedly hydronephrotic kidneys that were produced in less than an hour; and is evidenced by the fact that in the experiments in which the artery was clamped for one hour, as well as in those experiments in which the vein was clamped, urine containing sugar was found in the bladder. The bacteria, *Staphylococcus albus* and *Bacillus coli,* were introduced directly into the rubber tubing leading to the ear vein soon after the injection of sucrose was started. The animals were killed from fifteen minutes to two hours after the bacterial injection.

TECHNIC OF EXPERIMENTS

The experiments were carried out with the standard technic for obtaining the urine. The animals were chloroformed, the abdomen opened, the bladder seared in an avascular area, and the urine obtained by puncture with a sterile pipet.

Eighteen experiments, in which the renal artery was tied for periods varying from three minutes to two hours, were carried out (Table 1) as follows: In two experiments the artery was tied for three minutes, in three for six minutes, in four for ten minutes, in two for fifteen

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minutes, in one for thirty minutes, in three for one hour and in three for two hours. Duplicate plates on litmus lactose agar were made with 10 c.c. of urine, or as near that amount as possible.

Bacteria were not found in the bladder urine cultures when the intervals were one hour or less.

The urine of Rabbits 716 and 718, after the artery had been tied for fifteen minutes, and of Rabbits 735 and 734, after the artery had been tied for one hour, showed erythrocytes, but no bacteria could be cultivated. In two of the two-hour experiments bacteria were found in the bladder urine, but the specimens were too small to test for sugar;

Fig. 1.—Hydronephrotic kidney and ureter with control kidney.

in the third, the test was positive for sugar and there was blood in the urine, but no bacteria on culture. The details of this experiment are given in Table 1.

The nature of the experiments and the short time that elapsed between the tying of the vessels and the death of the animal make the likelihood of typical histologic changes relatively unlikely. In only two experiments was there a lapse of more than three hours from the time that the artery was tied to the death of the animal.

The kidneys of the animals in the three-minute group showed practically a normal epithelium. Those in the six-minute and ten-minute groups showed moderate to severe, granular and vacuolar degeneration. In the kidneys of the fifteen-minute group, the tubules at the surface of the kidney presented rather a narrow, smooth epithelium, whereas those adjacent to the medulla had the most marked vacuolar degeneration with granular detritus in the tubules. The specimens in the thirty-minute

group did not differ essentially from those of the fifteen-minute group. The animals whose arteries were clamped for sixty minutes showed extreme vacuolar degeneration in each instance, though not so much change as was present in some of the animals whose arteries were tied a shorter time. In the two-hour experiments the kidneys showed a very marked degeneration of the tubules with granular detritus in two instances, but not in the third. In one of the three there was pink granular material in the glomerular capsule.

Nineteen experiments were done in which the renal vein was clamped for varying periods of time (Table 2): in one experiment for one minute, in another for two minutes, in two for three minutes, in two

TABLE 1.—*Effect of Clamping the Renal Artery on the Excretion of Bacteria*

Rabbit	Minutes Renal Artery Clamped	Organism Injected	Minutes from End of Injection to End	Sucrose in Urine	Bacteria in Bladder Urine	Sucrose Injected, C.c.	Remarks
681	3	Bacillus coli....	15	+	0	173	
686	3	Bacillus coli....	35	+	0	160	
683	6	Bacillus coli....	20	+	0	173	
688	6	Bacillus coli....	45	+	0	190	
691	6	Bacillus coli....	75	+	0	310	
682	10	Bacillus coli....	15	+	0	125	
689	10	Bacillus coli....	40	+	0	475	Animal died in 40 minutes
690	10	Bacillus coli....	75	+	0	360	
712	10	Bacillus coli....	90	+	0	300	
716	15	Staphylococcus	60	+	0	270	Animal died in one hour
718	15	Staphylococcus	105	+	0	350	
719	30	Staphylococcus	95	+	0	200	Animal died in 95 minutes
722	60	Staphylococcus	40	—*	0	125	Animal died in 40 minutes
735	60	Bacillus coli....	125	+	0	300	
734	60	Bacillus coli....	90	+	0	300	
724	120	Bacillus coli....	95	+	0	100	240 c.c. saline solution
726	120	Bacillus coli....	35	—	+	110	Animal died in 35 minutes. 0.1 c.c. urine in bladder
727	120	Bacillus coli.....	25	—	+	115	0.1 c.c. urine in bladder

Right ureter tied, left renal artery clamped.
* Not enough urine for sugar test.

for five minutes, in four for ten minutes, in one for fifteen minutes, in two for thirty minutes, in three for one hour and in three for two hours. As in the previous artery experiments, the right ureter was tied so that the presence of sugar in the urine from the bladder gave evidence of secretion by the left kidney. *Bacillus coli* was injected in all but five animals, which received *Staphylococcus albus.*

In four out of sixteen experiments in which the urine from the bladder contained sucrose, bacteria were cultivated in the urine. In one three-minute experiment there were two colonies on one 10 c.c. plate, the other being sterile; in one ten-minute experiment there were six colonies on one plate, and the other was sterile; in a second ten-minute experiment in which the animal died at the end of forty-five minutes, there were numerous colonies on both plates; and the fourth, a sixty-minute experiment, in which the animal died at the end of thirty min-

utes, showed numerous colonies. There was no secretion or practically none, in the two-hour experiments, and in both instances bacteria were present in the urine. In removing so small an amount of urine from the collapsed bladder, contamination might easily result.

Two control rabbits that had the right ureter tied and the left vein clamped for one hour passed 80 c.c. in two and one-half hours, and 40 c.c. in one and five-sixths hours, respectively. Two control rabbits, having the right ureter tied and the left artery clamped for one hour, passed 35 c.c. in one and five-sixths hours, and 50 c.c. in three hours, respectively. The bladders of these animals were emptied at the beginning of the experiment.

TABLE 2.—*Effect of Clamping the Renal Vein on the Excretion of Bacteria*

Rabbit	Minutes Renal Vein Clamped	Organism Injected	Minutes from Injection to End	Sucrose in Urine	Bacteria in Bladder Urine	Sucrose Injected, C.c.	Remarks
697	1	Bacillus coli....	30	+	0	185	
698	2	Bacillus coli....	33	+	0	230	
695	3	Bacillus coli....	40	+	+	205	Two colonies on one plate, other plate negative
696	3	Bacillus coli....	60	+	0	182	
699	5	Bacillus coli....	45	+	0	285	
700	5	Bacillus coli....	65	+	0	360	
706	10	Bacillus coli....	30	+	0	125	
704	10	Bacillus coli....	45	+	+	200	Six colonies on one plate, other plate negative
709	10	Bacillus coli....	45	+	+	115	Animal died at end of 45 minutes, numerous colonies present
713	10	Bacillus coli....	60	+	0	125	Animal died at end of an hour
714	15	Bacillus coli....	20	+	0	100	Animal died in 20 minutes
720	30	Staphylococcus	30	+	0	200	Animal died in 30 minutes
735	30	Bacillus coli....	75	+	0	225	
723	60	Staphylococcus	30	+	+	200	Animal died in 30 minutes
731	60	Bacillus coli....	90	+	0	290	
732	60	Bacillus coli....	60	+	0	210	
725	120	Staphylococcus	50	0	—	100	100 c.c. saline solution also injected
728	120	Staphylococcus	60	0	—	250	
729	120	Staphylococcus	50	0	—	225	

Duplicate plates of 10 c.c. were used.
Right ureter tied, left renal vein clamped.

The one, two and three-minute experiments showed practically nothing histologically, except a slight change in the epithelium. The kidneys in the five-minute experiments showed marked granular and vacuolar degeneration of the epithelium, as also did those in the twenty-minute experiments. The kidneys in the fifteen-minute experiments revealed large numbers of bacterial colonies after five hours' incubation. In one of the thirty-minute experiments, definite cortical hemorrhages were noted in the kidney and blood cells were seen between, but not in, the tubules; the other thirty-minute specimen showed no hemorrhages. In two of the one-hour experiments, marked hemorrhages were present, but there was only a very slight hemorrhage in the third. In one, peripelvic hemorrhages also were noted.

In the two-hour experiments, epithelial changes were evident in the right kidney, but the kidney was otherwise normal. In the left kidney the epithelium was practically destroyed, cell outlines were indistinct and no cell structure was seen. Hemorrhages were not so numerous as in the one-hour specimens. Throughout the papillae there were large hemorrhages between tubules. Peripelvic hemorrhages were also present.

CONCLUSIONS

1. The renal filter remains intact for periods of one hour and even longer, when the renal artery has been clamped for periods up to one hour.

2. Clamping the renal vein for three minutes damaged the renal filter so that the bacteria passed through in forty minutes. In only four of sixteen experiments in which the renal vein was clamped for periods up to one hour were bacteria cultured from the urine.

PROGRESS IN PEDIATRICS

RECENT WORK IN ANATOMY, PHYSIOLOGY AND PATHOLOGY OF INFANCY AND CHILDHOOD*

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A cursory survey of the scattered notes on infant mortality statistics that find their way into general medical literature shows an excess of births over deaths in Germany, a decline in the birth rate in England, a changing relation in America and continued cause for apprehension in France and Belgium. The widespread interest in these new additions to the population is reflected in the establishment of schools for puericulture; in the appointment of commissions in various parts of the world, including South America, to study the causes at work in influencing infant mortality; in studies on the effect of race, social, educational and economic status on birth rate and infant mortality, and in many attempts to evaluate various procedures in prenatal, natal and postnatal care.

From England comes further emphasis on the need of special care for the child of preschool age, and from the League for Child Welfare meeting in Geneva, a declaration of rights for childhood in general.

The introduction of chemically acidified fresh cow's milk into infant feeding opens a new chapter of studies in nutrition. Further progress is reported in the control of diphtheria, measles and scarlet fever.

BIRTH RATE AND MORTALITY

In the United States of North America, the year 1923 showed lower birth rates and higher mortality rates. The Department of Commerce[1] announces that the birth rates (provisional) for 1923 were lower than for 1922 in twenty-one of the twenty-seven states for which figures are available. Infant mortality rates for 1923 were generally higher than for 1922. Birth rates ranged from 34.8 per thousand population (for cities in Wyoming) to 15.6 (for rural districts in Montana), and infant mortality rates ranged from 117 (for cities in South Carolina) to 51 (for rural districts in Utah and the cities of Washington). When larger cities are considered (twenty-five of forty-

* Received for publication, March 16, 1925.

1. Provisional Birth and Mortality Figures, J. A. M. A. **82**:1703 (May 24) 1924.

five with a population of 100,000 or more), the infant mortality rates for both years are lower than those for the previous year.

In England and Wales, the birth rate for 1923 (still tentative) appears to be the lowest on record, 20.2.[2] In recent years, there has been an almost continuous decline. The infant mortality rates also have been the lowest ever recorded in England (70 for England and Wales and 60 for London). While, on the whole, the infant mortality rates have been falling steadily, the present figures are attributed partly to the "comparative absence of severe epidemics of summer diarrhea and of measles."

The improvement in the infant death rate since 1901 is such that it more than half compensates for the decline in the number of births.

In Germany,[3] as a whole, there was a large excess of births over deaths, about 8.5 for each thousand inhabitants. The years 1919 and 1920 were record years in Germany for marriages; the number in 1922, though smaller than in 1921, shows 50 per cent. higher than before the war. The number of births scarcely corresponds to the number of marriages: for 1922, the rate was 22.6 per thousand inhabitants (the rate here includes stillbirths); in 1913, it was 28.6. The lowering of the birth rate, as compared with prewar times, is most marked in the large cities, but the rural districts also show a decrease. The decrease in the rate is sufficient to cause an absolute decrease in the number of births, but for the country as a whole leaves a large excess of births over deaths. This excess, however, is a third less than in the years just before the war.

In 1923, the rapid fall in the birth rate in the large cities of Germany caused much comment. For the first quarter, the rate stood at 16 per thousand, computed on a yearly basis. Berlin had the poorest record, with a rate of 10.6. For the third quarter, the rate for the large cities was 13.3. Berlin had then fallen to 8.7, a figure less than the general death rate, which was 10.2.

In Saxony, the number of births exceeded the deaths, though the excess is diminishing. Altogether, there were 30,000 fewer living births than in 1914 and the number of stillbirths also had diminished considerably. The infant mortality rate (12.61 per hundred living births for 1922 and 12.16 for 1923) was lower than before the war. The excess of births over deaths for the year was about half of that for 1913, and about one third of that for the first years of the present century.

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2. The Vital Statistics of 1923, J. A. M. A. **82**:314 (Jan. 26) 1924; ibid. **81**:1968 (Dec. 8) 1923.

3. The Birth Rate and Excess of Births over Deaths, J. A. M. A. **81**:1037 (Sept. 22) 1923.

In Bavaria,[4] the excess of births over deaths was about four fifths that of 1913. The prevailing economic stress is blamed for both a decreasing birth rate and an increasing general death rate.

To increased breast nursing of infants, a favorable summer and the presence of better food where needed as a substitute for breast feeding, is attributed a shift in the peak of infant mortality from summer to the transitional seasons when inadequate protection against "colds" and other infections is blamed for increased mortality.[5]

In France, the year 1923 gave an excess of 2.4 per thousand in births over deaths. The birth rate was 19.4 per thousand inhabitants, which was lower than the rates for 1921 and 1920, equal to that for 1922 and slightly higher than that for 1913. The general death rate dropped to 17.0 per thousand, having been 17.6 in 1922 and in 1913. The apparent increase in the excess of births over deaths in 1923 as compared with 1922 is almost entirely due to a decrease in the general death rate for the year. This excess, however, is lower than that for 1920 and 1921.

The proportion of marriages decreased to 18.2 per thousand, becoming but 20 per cent. more than in 1913. Moreover, during the century or more in which exact birth and death statistics have been kept in France, the birth rate has steadily declined. Curves prepared by Calmette show that during the first half of the century the number of births per thousand population was higher than the number of deaths, but that about 1855 the figures began to be more nearly equal, and from 1890 on the curves began to cross. Calmette estimates the World War not only cost France 1,500,000 lives but also prevented 1,560,000 births. It is further estimated that if the public health service of France were properly organized and the mortality rate brought down to that of more favored nations, there would be a saving of 180,000 lives yearly, and that with such a saving the population of France would remain around 40,000,000. As it is, the excess of births over deaths in France in 1920 and 1921 was only one-fifth to one-third as great, considered in proportion to the population, as that in Belgium, Austria, Germany, Spain and in Italy. Moreover, unless offset by economic and other factors, a depressing effect on the birth rate in the next few years may be expected from the decreasing number of marriages and from a probable higher death rate.

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4. The Excess of Births over Deaths in Saxony, J. A. M. A. **82**:1710 (May 24) 1924; Vital Statistics for Bavaria, ibid. **82**:1798 (May 31) 1924.

5. J. A. M. A. **82**:731 (March 1); Birth and Death Rates in France During the Last Hundred Years, ibid. 1561 (May 10); Vital Statistics for France for 1923, ibid., 1875 (June 7) 1924.

FERTILITY

Recent experimental studies on the relation between nutrition and fertility in the rat may prove to be of comparable importance in the human subject. Evans and Bishop[6] found that their "normal basic ration," that is, a casein-lard-cornstarch mixture used in studies on growth, failed to give normal fertility in a large proportion of female rats reared on it. The conditions produced did not interfere with the early steps in gestation. The ovulation and implantation ratio was normal, but from 80 to 100 per cent. of the implantations were resorbed.

Addition to the diet of fresh or dried whole milk, of cod liver oil, orange juice and yeast failed to act as curative agents. Nor was sterility influenced by changes in the quality or quantity of the protein in the basic diet, or variations of the proportions of the fat and carbohydrate content of the ration. There was no evidence that the salt content was at fault.

In two "clear instances of proven sterility," fertility was restored by adding leaves and high milk fat to the diet, given after ovulation had occurred. These authors believe that this form of sterility (in rats) may be prevented, or cured after its appearance in any individual by the addition of certain natural foodstuffs to the basic ration. Among these articles of food are lettuce, meat, whole wheat, wheat germ, rolled oats and large quantities of milk fats.

The unknown factor conferring fertility (X) could not be identified with the known vitamins A, B, C or D.

THE INFANT

The benefits to be expected from adequate antenatal care are described by Adair and Maland.[7] In reporting on 2,000 maternity cases in which antenatal care had been given, they enumerate (1) reduction of sterility by securing proper care for mothers and the consequent reduction of infection; (2) lessening of the number of abortions; (3) diminution in the number of premature deliveries; (4) reduction in the number of stillbirths; (5) saving of infant life during the neonatal period; (6) saving of health of the mothers; (7) virtual elimination of maternal deaths from toxemia and infection by proper instruction, supervision and treatment.

The prevention of threatened abortion, miscarriage and premature labor constitutes a very important phase of the prenatal care. There

6. Evans, H. McL., and Bishop, K. S.: Relation Between Fertility and Nutrition. III. Normal Reproductive Performance of the Rat, J. Metabol. Res. **3**:201 (Feb.) 1923.

7. Adair, F. L., and Maland, C. O.: Results gained in Maternity Cases in Which Antenatal Care Has Been Given, J. A. M. A. **81**:992 (Sept. 22) 1923.

were three ectopic pregnancies and one hydatidiform mole in their series. Prematurity occurred in 3.7 per cent. of the total pregnancies. Sixteen of the premature infants died within a week, five being nonviable; these constituted one third of the neonatal deaths.

Of the remaining twenty-six neonatal deaths, eleven had some brain injury, probably due to, or associated with, hemorrhage resulting from trauma or hemorrhagic disease; eleven died from congenital defects, and six from: toxemia (one), infection (one), accident of labor (one), and undetermined causes (three). The congenital defects were: mongolism (one), cardiovascular disease (four), defect of the central nervous system (two), defect of biliary tract (two) and enlarged thymus (one).

BIRTH INJURIES

There were sixty-eight natal deaths (stillbirths), of which thirty-seven were born at term and thirty-one prematurely. Of the latter, twenty-five died before the commencement of labor and six died during labor. The twenty-five antepartum deaths were attributed to: syphilis (two), toxemia (eleven), maternal infection (two), hydrops fetalis (two), monstrosity (one), accidents of pregnancy (four) and undetermined causes (three); while the intrapartum deaths were due to: toxemia (two), prolonged labor (one), faulty presentation (two), and in one case followed the birth of the second of twins.

Of the thirty-seven stillbirths at term, eleven died antepartum, the causes being: syphilis (one), toxemia (two), accidents of pregnancy (two), and undetermined cause (six); while twenty-six died intrapartum, the deaths being due to dystocia (sixteen), prolapsus funis (three), monstrosity (one), cerebral hemorrhage (one), toxemia (one) and undetermined cause (one).

Forty-five per cent. of the 2,000 mothers were primiparas, and 55 per cent. multiparas. The maternal mortality was 6, or 0.3 per cent. Gestation was terminated before the period of viability in 5+ per cent. Of the others, 91 + per cent. resulted in living infants—there were nine multiple pregnancies—and approximately 3 + per cent. in stillbirths.

The importance of good management of abortion is stressed, since infection may cause death or the morbidity and sterility of the prospective parent. In Adair and Maland's series about one pregnancy in ten terminated in an abortion. "This is much better than the usual ratio of one abortion to four pregnancies and is a definite accomplishment of antenatal care as shown, for instance, by the results of treatment of threatened abortions."

A clinical diagnosis of heart disease was made in about 4.5 per cent. of the women. Three patients died of pneumonia that developed during pregnancy. It was rarely necessary to terminate pregnancy because of pyelitis. Acute infections of the genital tract were rare; the incidence of syphilis was not over 0.5 per cent. There were no fatalities in six cases of diabetes.

Toxic symptoms appeared in 6.5 per cent. of the women; the effects on the offspring have been noted. The authors feel justified in concluding that maternal, but not fetal, deaths from toxemia may be practically eliminated by adequate antenatal supervision and intervention at the proper time (uterus emptied in six cases in this series).

True nephritis appeared in six cases, and fetal death occurred in three of these. The treatment of focal infection in the mouth, accessory nasal sinuses and pharynx was felt to be important, as such infections were relatively frequent.

The correction of malposition was of considerable importance. The number of infant deaths due to dystocia was considerable, though pelvic deformities were relatively uncommon among the women.

Maternal deaths totaled 0.33 per thousand living births. One half occurred from diseases which developed antepartum (pneumonia, etc.), and it is not seen how they could have been prevented.

McDowell[8] reports the conditions obtaining in the infants from 3,000 deliveries by version. There were 183 fetal deaths (4.6 per cent.), of which nearly half (49.2 per cent.) were stillborn. Deaths attributed to birth trauma were 38; to prolapsed cord, 4; to placenta previa, 7; to toxemia, 18; to fetal abnormalities, 2, and to craniotomies, 3. Hemorrhagic conditions are declared in most instances to have been the result of cord complications accompanied by asphyxia and placental complications.

Huenekens,[9] in considering the care of the new-born in the first few weeks of life, stresses chiefly those subjects that he thinks not sufficiently emphasized in the past, such as physical care of the new-born, congenital defects and injuries, infection, hemorrhage and feeding.

He thinks an oil rub may well replace the usual bath, especially for a debilitated infant during the first twenty-four hours. Water should be administered freely. Clubfoot should be treated as soon as possible after birth, and treatment for harelip and cleft palate begun within ten days after birth. In Erb's paralysis, for the first twenty-four

8. McDowell, H. C.: Postmortem Findings in the New-Born, New York State J. Med. **23**:143 (April) 1923.

9. Huenekens, E. J.: Care of the New-Born in the First Weeks of Life, J. A. M. A. **81**:624 (Aug. 25) 1923.

hours the injured arm should be held in a cast or splint over the head, with the humerus at right angles to the body, so that all strain may be taken off the deltoid muscle.

With modern aseptic technic, cord infection has become less important than formerly, but respiratory infections are becoming increasingly important. Gauze masks should be worn.

Hemorrhage of the new-born is known to be more common than was previously supposed. Warwick's [10] report is quoted as showing that cerebral hemorrhage is found in half the fatal cases in young infants, and that "hemorrhagic disease of the new-born," a very important cause of cerebral hemorrhage, is found in about half of these. Other causes are: trauma in normal or rapid delivery, and asphyxia in slow deliveries. Rhodda's test is described and urged as a routine, and the use of whole human blood subcutaneously when indicated.

The common practice of circumcision in the first week of life is thought undesirable: (1) from the increased danger of hemorrhage and (2) because of the ease with which, in most infants, the normal adhesions of the prepuce at birth can gradually be broken during the early months of life, thus abolishing the necessity for operation.

Infant feeding is said to divide with hemorrhage the honor of being the most important factor in neonatal mortality, and it is claimed that more than 95 per cent. of babies can and should be breast fed. The author's methods of attaining this are described.

The giving to infants of a prophylactic injection of blood, usually from the father, as a routine procedure in cases of severe labor and forceps delivery during the last year, was reported by Helmholz.[11]

Kuttner and Ratner [12] studied eighteen infants in whom the possibility of receiving colostrum was excluded and found no evidence of harm to the infant due to omission of colostrum feeding, thus confirming the opinion that colostrum feeding has for the human infant no significance in any way comparable to that found for the feeding of calves.

Stern and Schwartz [13] state that many instances of asphyxia, debility and convulsions are merely symptoms from cerebral lesions. They hold that a large number are due to hemorrhages caused by the difference between a high intra-uterine and a low external pressure. Nystagmus receives special consideration in their report.

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10. Warwick, M.: Cerebral Hemorrhage of the New-Born, Am. J. M. Sc. **158**:95 (July) 1919.

11. Helmholz, H. F.: J. A. M. A. **81**:626 (Aug. 25) 1923.

12. Kuttner, A., and Ratner, B.: Importance of Colostrum to the New-Born Infant, Am. J. Dis. Child. **25**:413 (June) 1923.

13. Stern, A., and Schwartz, P.: Birth Injuries, Klin. Wchnschr. **3**:931 (May 20) 1924.

Spontaneous nystagmus and the intensity of deformation of the skull were studied in 100 infants. Nystagmus was present in one third of forty-four normally delivered infants, and in all of eleven with faulty presentation. Spontaneous nystagmus was present in twenty out of twenty-four contracted pelvis deliveries, and in sixty-one out of sixty-nine infants with marked molding of the head; however, it was present also in eighteen out of twenty-eight infants with normally shaped skulls. The infants delivered by cesarean section had round heads and no nystagmus.

Ehrenfest [14] believes that there is a tendency at the moment to lay undue emphasis on a hemorrhagic diathesis in the causation of birth hemorrhage, and that the widespread significance of artificial, mechanical and physiologic trauma incident to birth is being underestimated. The more carefully postmortem examinations are made, the more frequently are evidences found of unsuspected injuries to the meninges and other structures.

INTRACRANIAL HEMORRHAGE

Ehrenfest calls attention to the work of Graham as having "established the fact that all those conditions of the new-born which are characterized by a hemorrhagic tendency most probably are the result of a deficiency in oxidation, and can be experimentally produced by chloroform as well as by direct asphyxiation," and adds that these are indeed findings of far-reaching importance in clearing up some of the obscure points in the etiology of intracranial birth hemorrhages, and their relation to asphyxiatic and hemorrhagic diathesis. Ehrenfest presents pictures of injuries to the falx and tentorium at birth, and vigorously combats the view (Munro and Eustis) that intracranial birth hemorrhages are but rarely traumatic in origin.

Saenger [15] found macroscopic intracranial hemorrhages in seventy-three of 100 new-born infant cadavers. The tentorium was intact in only three of forty-six with much hemorrhage and in fifteen of the twenty-seven with slight hemorrhage. He thought there was usually a combination of disturbance in the circulation and direct injury from force. Aftercoming heads showed the most marked injuries. In thirty-four of the infants there was no sign of life, but meconium was found in the bronchi; in twenty-four the heart was beating, but the infant could not be revived; the others survived for from one hour to three days.

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14. Ehrenfest, H.: The Causation of Intracranial Hemorrhages in the New-Born, Am. J. Dis. Child. **26**:503 (Dec.) 1923.

15. Saenger, H.: Intracranial Hemorrhage in the New-Born, Monatschr. f. Geb. u. Gynäk. **65**:258 (Feb.) 1924; abstr. J. A. M. A. **82**:1485 (May 3) 1924.

Wing [16] says that asphyxia of the infant during birth has an influence on the stability of the blood and impairs the clotting power. This renders infants who have suffered from mechanical causes of intracranial lesions especially susceptible to both immediate and delayed hemorrhagic lesions.

Sharpe [17] reminds us of the changes in the point of view that have taken place in recent years in the matter of intracranial hemorrhages in the new-born. For many years it had been recognized by obstetricians that severe intracranial injuries of the new-born could occur at the time of birth, particularly with difficult, prolonged labor and with the use of instruments of the type known as "high forceps." When death occurs, and the actual intracranial lesion of extensive hemorrhage is demonstrated at necropsy, the opinion may be expressed that it was fortunate—both for the relatives and for the child itself—that death intervened and spared all those concerned, including the taxable community with its overflowing state institutions.

Now attention is centered on recognition of the milder cases, and treatment of them. The close relation of these milder, and often unrecognized, cases to Little's disease appearing later in life, and often after months of apparently normal development, is emphasized by Sharpe. He thinks that too often the signs appearing later in life are ascribed "to some mysterious lack of development of cerebral tissues, heredity, syphilis and other hopeless conditions which dismay the parents on account of the fear of having future children."

The frequent use of lumbar puncture in the new-born is advocated by Sharpe.

Acute intracranial hemorrhage and cerebral edema of varying amounts in the new born occur rather frequently. The simple method of lumbar puncture within the first week after birth may be used to demonstrate the presence or not of free blood in the cerebrospinal fluid; if present, then the natural means of its absorption can be aided by the repeated lumbar punctures of spinal drainage; and, if not present, then an intracranial hemorrhage lesion can be practically excluded. The mildness and almost lack of clinical symptoms and signs, even in the presence of extensive intracranial hemorrhage and cerebral edema in the new born, emphasize the advisability and importance of an early lumbar puncture, both as a diagnostic and as a therapeutic measure, in any suspected case of an intracranial lesion in the new born, irrespective of the type of labor. The early recognition of an intracranial hemorrhage in the new born and the appropriate treatment will thus tend to lessen that large chronic group of physically impaired and mentally retarded children.

Sharpe performed a series of lumbar punctures on 100 consecutive new-born infants in a hospital service. He found free blood in varying amounts of cerebrospinal fluid at lumbar puncture within from twelve

16. Wing, L. A.: Hemorrhage in the New-Born, Bull. Lying-In Hosp. **12**:253 (Aug.) 1923.

17. Sharpe, William: Intracranial Hemorrhage in the New-Born, J. A. M. A. **81**:621 (Aug. 25) 1923.

to forty-eight hours after birth in nine of the infants (9 per cent.). Five of these infants came from apparently normal births and appeared themselves to be normal, being without marked symptoms or signs of an intracranial lesion. In four infants the hemorrhage was of large amount, and two died—one, an infant, aged 7 months, showing a right ventricular hemorrhage at necropsy, the other showing a subarachnoid hemorrhage with extensive cerebral edema. In the other ten patients only the so-called mild clinical signs were seen, namely, drowsiness, refusal to nurse and no muscular twitchings.

Varying conditions of the fontanels were noted. The intracranial pressure, as registered by the special mercurial manometer, varied from 16 to 12 mm. in the two patients dying to 10 mm. in babies having flush fontanels, and to 8 mm. in two babies with relaxed fontanels.

The amount of blood obtained at puncture varied from merely a reddish tinge in five cases to almost pure blood in four. In five other cases the fluid was blood-streaked, either as it dripped from the needle or as it collected in the test tube, and an immediate puncture one lumbar space higher up gave clear fluid, showing that the blood had been due to the puncture itself.

Sharpe believes that undoubtedly the repeated lumbar puncture for spinal drainage aided the natural means for resorption and in this manner the infant's recovery was facilitated, both as to life and as to future normalcy.

In the other infants was recorded an almost uniform spinal pressure of 8 mm. of mercury within the first forty-eight hours after birth. Not until two weeks later did lumbar punctures show the normal pressure of from 3 to 5 mm. in the infants of this series. Sharpe asks whether this temporary mild cerebral edema at the time of birth is a protective mechanism to lessen the danger of cerebral trauma, or if it is the result of cranial molding and possibly mild trauma.

Sachs,[18] in a discussion of this paper, protested strongly against placing much reliance in these degrees of change in the spinal pressure, saying that in Marriott's service he had found a wide range of pressure in infants that were not traumatic or tumor cases.

Sherman and Lohnes [19] report on the bleeding and coagulation time in 100 cases. In twelve the clotting time was prolonged to from ten to sixteen minutes, and in twenty-eight the bleeding time was prolonged to from six to twenty-five minutes. There was only one case of cerebral hemorrhage detected; this infant had a bleeding time of ten minutes the second day, and a clotting time of fifteen minutes, a figure which fell rapidly after the subcutaneous injection of 10 c.c. of whole blood.

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18. Sachs, Ernest: Discussion, J. A. M. A. **81**:627 (Aug. 25) 1923.
19. Sherman, D. S., and Lohnes, H. R.: Bleeding and Coagulation in the First Week of Life, New York State J. M. **23**:146 (April) 1923.

The authors think there is a definite blood dyscrasia of the newborn, a condition not due to immature development, not more frequent in the prematurely born infants, and characterized by prolonged bleeding time rather than by prolonged clotting time.

Gordon,[20] after citing statistics to show that 90 per cent. of intracranial hemorrhages of the new-born are meningeal hemorrhages, concludes that the cause of meningeal hemorrhages is, principally, the tearing of the membranes due to their over-stretching, which leads to rupture of the blood vessels. To produce a tear there must be great cranial stress, and thought is to be directed to minimizing the likelihood of such stress being exerted.

In therapy for infratentorial cases, lumbar puncture, first advocated by Devraigne (1905), may be of considerable benefit, it is believed, and cases in the literature are referred to briefly. For supratentorial cases, lumbar puncture does not avail much, as the blood cannot reach the subarachnoid cavity easily, and early craniotomy is held to be directly indicated. Reference is here made to the experience of Cushing (1908) and Henuken (1912), with the conclusion that it seems logical in all cases indicating increased intracranial pressure at birth, that lumbar puncture should be resorted to at once, before a definite localizing diagnosis is made, since in the infratentorial group it is of definite therapeutic value, and in the supratentorial group the diagnosis may be promptly established.

Kohlbry [21] notes that cases of birth hemorrhage into the spinal cord are not numerous in the literature, though they probably occur more frequently than is generally supposed. Most work on the subject has been done quite recently. The most comprehensive article is that of Crothers,[22] who quotes Head and Riddoch at some length.

Kohlbry describes a case of birth hemorrhage into the spinal cord seen by himself. The child was born by breech extraction, and some difficulty was encountered with the aftercoming head. The child showed a typical picture of cervical cord injury; there was no evidence of hemorrhage elsewhere. The hemorrhage was evidently below the level of origin of the phrenic nerves for the diaphragm functioned normally. The breathing was diaphragmatic, there being paralysis of the thoracic and abdominal muscles. The position of the arms was characteristic.

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20. Gordon, Alfred: Meningeal Hemorrhages in the New-Born and Their Remote Consequences, Am. J. Dis. Child. **27**:303 (April) 1923.

21. Kohlbry, C. O.: Birth Hemorrhage into Spinal Cord with Resultant Bladder and Kidney Complications. Report of Case, Am. J. Dis. Child. **26**:242 (Sept.) 1923.

22. Crothers, Bronson: Injury of the Spinal Cord in Breech Extraction as an Important Cause of Fetal Death and of Paraplegia in Childhood, Am. J. M. Sc. **165**:94 (Jan.) 1923. Head, H., and Riddoch, G.: Brain **40**:188, 1917.

The legs were paralyzed. As the result of bladder paralysis with back pressure, the child developed double hydro-ureters and hydronephrosis, with infection of the kidneys and the bladder, and died at the age of 9 months. Necropsy revealed a complete degeneration of the cord in the lower cervical region.

Penfield [23] reports the findings in a boy, aged 16 months, whose condition, developing at about the age of 13 months, was at first indistinguishable from simple obstructive hydrocephalus, but was later shown to be better explained by the assumption of an exudation of fluid into the subdural space, associated with or caused by an inflammatory process (otitis?) that gave rise to fever. This fluid continued to accumulate, causing arrest of development, vomiting and eventual blindness. Puncture of the dura at the anterior fontanel, made with the intention of puncturing the lateral ventricle, yielded abundance of clear, pale yellow fluid; lumbar fluid was colorless. Study of pneumograms made after the withdrawal of 45 c.c. of fluid and its replacement by an equal amount of air, led to the conclusion that there was no connection between the fluid cavity (or cavities, one on each side of the midline) and the subarachnoid fluid. Chemically, the subdural fluid differed very materially from the spinal fluid.

It is found interesting to recall that there are studies (1907 and 1910) showing a not infrequent association of otitis media with disturbances of sight, ocular movement and vomiting. Subdural fluid under tension offers a mechanical basis for increased intracranial pressure leading to the symptoms. Penfield's report is well illustrated.

THE PREMATURE INFANT

In a German training school for midwives, prematurely born infants are said to form about 10 per cent. of the deliveries. Brandt [24] investigated the further development of 292 infants whose weight at birth was under 2,500 gm. and whose length was under 46 cm. He traced 262 of these 12 months after birth, and found that 42 per cent. of them had died by that time. Most of those surviving were physically or mentally below the average.

Looft [25] considers that rickets is the main cause of the frequent slow mental development of prematurely born infants in the first two or three years of life.

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23. Penfield, W. G.: Subdural Effusion and Internal Hydrocephalus, Am. J. Dis. Child. **26**:383 (Oct.) 1923.

24. Brandt, P.: Fate of the Prematurely Born, Monatschr. f. Kinderh. **27**:209 (Dec.) 1923

25. Looft, C.: Mental Development of Prematurely Born Rachitic Infants, Monatschr. f. Kinderh. **25**:420 (March 25) 1923.

Brandt emphasizes the value of using external heat as the most important therapeutic measure in the care of prematurely born infants.

Talbot [26] and his co-workers say that, when cold, the premature infant has not the strength to form heat by exercise, and although muscular activity—kicking and crying—affects the basal metabolism of the premature infant as it does that of the normal infant, sometimes adding 40 per cent., yet the premature infant, instead of shivering and crying, as does the healthy full-term infant, lies quiet, and the lost heat is not replaced.

INFANT MORTALITY

Foote [27] points out some of the difficulties attending attempts to get a correct picture of infant mortality in the first month of life. The international list of causes of death is notable for its omission of many important causes which are generally, if not peculiarly, responsible for infant deaths in the first month of life. For example, birth injury from forceps is mentioned, but from other causes ignored. Confusion is caused by the fact that many of the titles are symptoms of one or more specific conditions and are not the primary causes of death. Since the general statistics as now classified are not specific enough, Foote attempted to compare the causes of death associated with 1,388 live births at a Class A maternity hospital, with the figures for the general population of the surrounding city, with its 9,121 live births. Certain differences stand out prominently. Hospital statistics usually record a higher ratio of birth injuries—9.4 per cent. of all the deaths as against 6.7 per cent. for the community. (In another community, rates of 15.5 and 13.5 per cent., respectively, were obtained; strictness in classification may play a part.)

Hemorrhage, more particularly the occult forms occurring within the cranial cavity, is a cause of death, the importance of which seems not well recognized. Of all deaths within the first month, 20.7 per cent. of those in hospitals and 5.1 per cent. of those in the community were due to hemorrhage. Certain hospitals report intracranial hemorrhage as birth injuries; the incidence, however, under any classification in community or hospital, does not approach the necropsy percentage. Better recognition and treatment of these cases would save many lives.

Congenital deformities were accorded apparently the same percentages—7.6 and 7.5, respectively, in the hospital and in the community, but two thirds of the malformations in the general community were

26. Talbot, F. B.: Sisson, W. R.; Moriarty, M. E., and Dalrymple, A, J.: The Basal Metabolism of Prematurity. III. Metabolism Findings in Twenty-one Premature Infants, Am. J. Dis. Child. **26**:29 (July) 1923.

27. Foote, John A.: Infant Mortality in the First Month of Life, J. A. M. A. **81**:1349 (Oct. 26) 1923.

given as heart lesions and of one variety only, patent foramen ovale. Authorities are cited to show that patent foramen ovale, even when marked, is rarely a primary cause of death. Holt is cited to show that among all cardiac anomalies, patent foramen ovale alone would have a percentage of 3.7 per cent. as a cause of death, and this defect complicated by other pathologic conditions, 3.3 per cent. Birnbaum is quoted as finding four cases of fatal congenital heart disease among 4,200 births. The usual rates for congenital heart disease in death statistics are much too high.

Curtis and Taylor [28] analyzed 1,000 records of infants selected at random. All diseases of the new-born were eliminated from this series. Of the 1,000 infants, fifty-one died. In seventeen, the cause of death was unknown. Pneumonia caused sixteen deaths and the other eighteen were caused by various diseases. Diarrheal diseases did not play a great part in the mortality, causing but four deaths. Seven children contracted diphtheria and three died. Of ten premature infants, three died.

The morbidity rate was about nine times as great as the mortality rate. Five hundred and thirty-five of the 1,000 infants were "entirely free from disease" during the time that they were under observation, a period varying from twelve to twenty-four months. Of these 535 infants, 318 were entirely breast fed during the whole of the first year of life, and the majority of the remaining were breast fed for at least six months. Of the infants that were bottle fed entirely, 36 per cent. had no disease during the first year.

Carr and Ratner [29] assert that not enough is done for infants between the time that the mother leaves the maternity hospital and the time that she seeks medical advice for her baby. This results in the development of many preventable conditions, impedes the progress of the infant, and an opportunity for training an inexperienced mother is lost. Description and routine of a clinic which followed 410 infants is given, and the results are said to show its value in the prevention of disease and in the correction of minor ailments.

"COLDS"

Winholt and Jordan [30] studied 1,000 babies with reference to the conditions attendant on the development of "colds" by young children. They point out that the degree of infectivity of the common cold has

28. Curtis, R. D., and Taylor, G.: Incidence of Disease in One Thousand Infants Under Two Years of Age, Am. J. Dis. Child. **26**:391 (Nov.) 1923.

29. Carr, W. L., and Ratner, B.: Results of Follow-up Work with Infants in a Maternity Hospital, Am. J. Obst. & Gynec. **7**:73 (Jan.) 1924. Carr, W. L., and Ratner, B.: J. A. M. A. **81**:330 (July 28) 1923.

30. Winholt, W. F., and Jordan, E. O.: Epidemiology of Colds in Infants, J. A. M. A. **81**:280 (July 28) 1923.

never been definitely ascertained, that the share of any outside infecting agent as a determining factor has often been questioned and stress laid, instead, on temporary lowering of resistance, protein sensitization and similar factors; they also note that the ordinary method of establishing transfer of infection by tracing a new case to contact with a preexisting case is obviously difficult to apply to adults because of the numerous contacts that the average adult has in everyday life. It was thought that a study of colds in infants in whom contacts are fewer and comparatively easily traced might afford data of some value.

The term "cold" was used to cover such terms as "coryza," "rhinitis," "cold in the head," "nose cold," and "running nose," but not "tonsillitis," "pharyngitis" or "sore throat."

During the months of October, November and the following January and February, careful records were obtained of the occurrence of these colds among babies between the ages of 1 month and 2 years brought to infant welfare conferences. Records of 500 cases of cold were studied, and a control series provided by taking a similar record on a normal baby every time a cold record was taken.

There was a distinct history of a cold in some member of the family in 290 of the 500 families in which the baby had a cold, but in only 180 of the families to which the normal babies belonged.

TABLES 1.—*Incidence of Colds in Infants Among Families with Other Members Affected*

	Mother with Cold		Father with Cold		Other Members of the Family with Cold	
	No.	%	No.	%	No.	%
Babies with colds.....	142	29	30	6	118	23
Babies without colds.....	66	13	33	6	81	16

The figures in Table 1 seemed to indicate that in families in which there are babies with colds there is much more likely to be a history of cold in the mother than in families in which the babies are free from colds, and that the occurrence of a cold in the father is not manifestly related to a cold in the baby. The relatively close and prolonged association of mother and baby may account for the difference.

The babies having colds were—in material selected in this manner, at least—much more frequently between 4 and 8, or 8 and 12 months of age, than in those younger or older.

The time elapsing between exposure to a cold in a member of the family and development of cold in the baby was most commonly "a few days," or, in those cases in which more exact statements were obtained, from seven to ten days.

If data were available, the most definite information regarding the incubation period would be obtained from the history of a single exposure to an outsider. In the present records twenty-seven such instances appeared, and the baby's cold developed in one day (eight cases), in two days (seven cases), in three days (four cases), "in a few days" (four cases), in a week (three cases) and in two weeks (one case). (In the 289 cases in which the source of infection was thought to be in the family and the time relation tabulated, fifty-nine babies were thought to have developed the cold two weeks or more after exposure.)

Whether breast feeding protects a baby against "colds," or renders it less susceptible to them, is not clearly shown in the tables. Indeed, superficially examined, the tables would suggest, if anything, slightly greater susceptibility, which would be contrary to the general impression that breast fed babies have a greater resistance to infection than those artificially fed. However, age differences and other factors are concealed in the figures. It is also possible that closer association with the mother more than neutralized any greater resistance in the breast fed.

Some interest attaches to the association of other, and perhaps predisposing, conditions with the occurrence of colds. The babies under study were selected from those visiting a clinic or welfare conference, the function of which is the care of well babies, the primary object being proper feeding. However, babies with various ailments were occasionally brought to the station and afforded the figures shown in Table 2.

TABLE 2.—*Ailments Other than Colds*

	Babies With Colds	Babies Without Colds
Umbilical hernia	3	3
Severe eczema	6	3
Heart lesions	2	1
Athrepsia	10	1
Syphilis	2	1
Rickets (extreme cases)	6	3
Anemia	2	1
Diarrhea	3	1

It would seem that such a condition as umbilical hernia, which is not closely related to the vitality of the child, is evenly distributed between the two groups, while other conditions, such as severe eczema, rickets and athrepsia, which presumably affect resistance or indicate a general lowering of resistance, are present in the babies with colds in much higher proportion than in the babies without colds.

The findings suggest the presence of relatively widely disseminated virus of low infectivity. Apparently, close contact, like that obtaining between mother and child rather than that obtaining ordinarily between father and baby, is needed for effective exposure. The general resistance of babies to such exposure as prevailed in this series seems quite high,

since the babies exposed to mothers' colds without getting them were nearly half as numerous as those presumably similarly exposed who did get them.

Salmony [31] compares the morbidity in 145 infants less than 3 months of age who had been kept separate from other infants, with the morbidity in 145 kept with older infants, and confirms anew the special advantages of isolating young infants.

When Labbe [32] held that keeping infants in institutions is not necessarily fatal, and, while admitting that the mortality in some of them is 40 per cent. or more, held that that proved only that they were not wisely managed, since in the infant asylum at Porchefontaine there is a mortality of only 5 to 7 per cent., Marfan pointed out that this institution owes its results to the fact that it admits mothers, and that they nurse other infants besides their own.

INFANT FEEDING

Schlossmann [33] presents figures showing a rapid increase in the percentage of breast fed infants and adds: "The royal highnesses who nurse their own children do more for child welfare in general than those who are patronesses for asylums for infants."

McKay [34] reviews various surveys here and abroad, tending to show the superiority of breast feeding over artificial feeding. He holds that there is ample proof that the mortality rate among artificially fed babies is from three to five times as high as among the breast fed. There is evidence of a decided decrease in morbidity among the breast fed. The longer the period of breast feeding the lower the infant mortality, and the longer the period of artificial feeding the higher the infant mortality rate. Mortality rates are higher, he states, for all causes of death among the artificially fed than among the breast fed and much higher for gastro-enteritis and respiratory diseases.

Allen and Bagg [35] analyzed 500 consecutive cases with reference to infants' gain in weight. They concluded that babies born in a hospital enjoyed a distinct advantage over those born at home in likelihood of normal gain; that prolonged use of breast milk, alone or supplemented, tends to increase the rate of gain in weight, and that diarrhea is the

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31. Salmony, L.: Relative Isolation of Infants, Arch. f. Kinderh. **73**:157 (July 21) 1923.

32. Labbé, M.: Dangers of Infant Asylums, Bull. de l'Acad. de méd., Paris **91**:269 (March 4) 1924.

33. Schlossmann, A., Schlossmann, E., and Pankow, O.: Increase of Breast-feeding, Klin. Wchnschr. **3**:79 (Jan. 8) 1924.

34. McKay, F. L.: Infant Mortality in Relation to Breast Feeding, New York State J. M. **24**:433 (March 28) 1924.

35. Allen, F. H., and Bagg, E. P.: Factors Governing Gain in Weight in First Year, Boston M. & S. J. **189**:349 (Sept. 6) 1923.

most frequent complication and ranks highest among the diseases tending to prevent the normal gain in weight. Babies born overweight in the main do better than those of normal weight or those underweight. Normal babies of the second pregnancy outrank both groups. Abnormalities tend definitely to subvert normal gain in weight, but not particularly in any one group.

Funkhouser [36] makes an appeal for modification of the mother's milk to the digestive ability of the infant, rather than trying to adjust any substitute. If the fat content is high and the baby vomiting a sour, curdy material, and there are many fat curds in the stool, water may be given before nursing and the feeding interval lengthened. A complemental feeding of a mixture low in fat, such as skimmed milk mixture or a solution of calcium caseinate, may be given after nursing. For the best possible results in all procedures, one should secure the mental rest of the mother. Weighing should be done but once a week, except by order from the physician.

Chapin [37] describes the operation of what he calls "a breast milk dairy." The health stations of the department of health were utilized in procuring the milk. A matron was installed in the station and mothers willing to sell their milk were required to come to the station. The time was left optional with each mother, and the conditions imposed were soon accepted. The matron instructs and supervises the mother, sterilizes the bottles and fills orders during the morning. In the afternoon she goes out to visit new mothers in order to work up her clientele. Only mothers having more milk than needed by their own babies were used. The baby must be under the care of a physician and a nurse in the health station, and the case recommended by them. The mother may come in once or twice a day and if she lives at a distance carfare is paid if she can give 10 or more ounces (300 c.c.). The milk has been found to cost 13 cents an ounce, 10 cents being paid to the mother and overhead charges being 3 cents. It is sold for 15 to 20 cents an ounce according to the financial status of the purchaser in private cases, and to hospitals for 10 cents an ounce.

Those buying milk are required to pasteurize it, as no Wassermann tests are made on the mothers. Dr. Park, director of the laboratory of the department of health, is cited as having rendered the decision that any possible danger would be eliminated if this precaution was taken.

One healthy young Italian mother, whose baby was being overfed and was not thriving, earned about $1,000 during 1922, and the baby

36. Funkhouser, W. L.: Modified Breast Milk, J. A. M. A. **82**:1811 (May 31) 1924.

37. Chapin, H. D.: The Operation of a Breast Milk Dairy, J. A. M. A. **81**:200 (July 21) 1923.

improved when relieved of some of the surplus. Early work of this nature by Talbot (1910) in Boston, and by Hoobler (1912) in New York and Detroit, is recalled.

Reber [38] believes that human milk, sterilized and bottled, could be marketed on a comparatively large scale, since it is just as nourishing as when fresh. However, the taste and appearance of this preparation are not yet very inviting.

LOSS OF WEIGHT IN NEW-BORN

Numerous studies have appeared in recent years tending to show that the initial loss of weight in the new-born is, in a large degree, preventable. It was previously argued that the gastro-intestinal tract is immature in the earliest days of life, that a few days were required for adjustment to the new functions that confront it when food intake begins and that nature furnished colostrum for this period. Calorimetric studies have shown that a condition of semistarvation ensues until the intake of food becomes adequate.

Bachmann,[39] in observing several hundred new-born infants, failed to note digestive disturbance either while early complemental feeding was being given or after the secretion of the mother's milk was established. His babies showed an average initial loss of 5 per cent. of the body weight in contrast to the 9 per cent. commonly noted. He found the best results were obtained with formulas containing a relatively high sugar content, and concludes that the giving of simple formulas to the new-born infant causes no clinical disturbances and is justifiable.

As a matter of fact, this appears to have been the practice among various peoples for centuries. Immigrants from southeast Europe have been giving sugar solution to their new-born, doing it because their ancestors for generations had found it useful. Primitive tribes have used substances containing sugar, such as honey, coconut milk, fruit and sugar-cane juice.[40]

Schoedel [41] discusses the feeding requirements of weakly infants. Breast milk is best. If the child does not voluntarily take enough, the supplementary amount can be given by tube. From 120 to 150 calories per kilogram are needed.

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38. Reber, M.: Sterilized Human Milk, Schweiz. med. Wchnschr. **54**:198 (Feb. 21) 1924.

39. Bachmann, H. A.: Observations on the Effect of Complemental Feeding in New-Born Infants, Am. J. Dis. Child. **26**:349 (Oct.) 1923; editorial, J. A. M. A. **82**:305 (Jan. 26) 1924.

40. Fishberg, Maurice: "The Care and Feeding of Infants," J. A. M. A. **80**:421 (Feb. 10) 1923.

41. Schoedel, J.: Requirements of Weakly Infants, Jahrb. f. Kinderh. **102**:227 (June) 1923.

NUTRITION

A most interesting application of the principles of the newer chemistry of infant feeding is that recently reported by Faber [42] and Marriott.[43]

It has long been known that young infants do not digest cow's milk as well as human milk with a corresponding percentage of protein. Exceptional infants seemed to digest whole cow's milk, but for most it has been found necessary to dilute the milk with water, cereal gruel or other diluent. Then sugar was added to enhance the relatively low caloric value of the diluted cow's milk. This gives essentially the formulas customarily used.

The difficulty experienced in digesting the undiluted cow's milk was attributed commonly to the foreign nature of the protein of cow's milk and its different relative composition. That sugar should be added seemed logical in view of the high content of this substance in woman's milk. As ordinarily prepared for the young infant, the total day's feeding of such mixture contains a relatively small amount of protein as compared with feedings of breast milk having the same caloric values for the twenty-four hours; the fat is low—less so if top-milk has been used—and compared with the amount of protein and fat in the mixture, the sugar is relatively high. Hence, says Faber, these infants lose certain benefits incidental to an adequate intake of milk fat, such as vitamins and substances necessary to normal stool formation, and are subject to the risks of high carbohydrate feeding. It has been found, however, as Marriott recalls, that buttermilk is better tolerated by infants than sweet milk. This fact was empirically discovered, and buttermilk, whether alone or in combination with curds as protein milk, is now used as a routine by pediatricians in the treatment of intestinal disturbances of infants with excellent results. Faber notes that on soured milk infants with previously disturbed digestion are frequently able to take fat in much higher percentages than are customarily given even to healthy infants fed on sweet milk. Moreover, sour milk can often be taken with little or no dilution, so that a smaller volume suffices to meet caloric requirements.

The effects of protein milk are characteristic. The diarrhea ceases, usually within forty-eight hours, with a striking change in the stools, which become grayish and pasty in consistency, being composed largely of calcium soaps. These stools suggest to Faber an increase in

42. Faber, H. K.: Hydrochloric Acid Milk in Infant Feeding, Am. J. Dis. Child. **26**:401 (Nov.) 1923.

43. Marriott, W. McK., and Davidson, L. T.: The Acidity of the Gastric Contents of Infants, Am. J. Dis. Child. **26**:542 (Dec.) 1923; ibid., Acidified Whole Milk as a Routine Infant Food, J. A. M. A. **81**:2007 (Dec. 15) 1923.

lipolysis as the outstanding effect of the milk, and the reaction of such milk strongly suggests that lipolysis in an acid medium, that is, in the stomach, has been favored.

HYDROGEN ION CONCENTRATION

Faber cites the work of Kronenberg (1915) and of Marriott (1922), showing that during the first year the average normal infant exhibits at the height of digestion a range of gastric acidity that lies between p_H 3.5 and 5.0.

The effective "strength" of any acid solution may be expressed in terms of the number of grams of ionized hydrogen present in solution. A normal solution of hydrochloric acid contains approximately 1 gm. of ionized hydrogen per liter; a tenth normal solution 0.1 gm. of ionized hydrogen, and a millionth normal solution 0.000001 gm. In order to simplify the expressions and to avoid the use of many ciphers, it is customary to use logarithmic terms with negative exponents and indicate a tenth normal solution of acid as having a hydrogen-ion concentration of 10^{-1}, a millionth normal solution as 10^{-6}, or more simply as p_H 1, p_H 6, etc.

According to Faber, between this p_H 3.5 and 5.0, of the normal infant at the height of digestion, and the range of acidity required for the action of the gastric enzymes, as determined in vitro, there is an interesting relationship of much significance in the physiology of infant digestion. Rennet, acting best between p_H 6.3 and 6.0, curdles milk soon after ingestion, before the height of gastric acidity has been attained. Chymosin (van Dam), an enzyme with feeble proteolytic powers about which little is known, acts best at p_H 5.0. Gastric lipase and invertase (the latter studied, however, from yeast) are half active at about p_H 6.0, and fully active between p_H 4.5 and 4.0. Pepsin requires a much higher acidity, beginning to act at p_H 5.0, and developing half activity at about p_H 4.0 and full activity only at p_H 2.3, a point rarely if ever reached in the infant's stomach. As tested by the newer methods of examination, the determination of the hydrogen concentration, the acidity of the gastric contents of a group of normal breast fed infants at the height of digestion averaged p_H 3.75. The different enzymes appear to require that the gastric acidity shall reach a threshold of about p_H 5.0 before any of them, excepting rennet, become usefully active. Therefore it is assumed that the infant's stomach cannot perform its task in the digestive process unless it is able to produce enough hydrochloric acid to raise the level of acidity to this point.

Milk, the chief food of infancy, offers a marked resistance to this change in reaction because of the content of buffer substances. This is particularly true of cow's milk. To bring human milk up to the threshold acidity of p_H 5.0, it is necessary to add to each 100 c.c. the equivalent of 15 to 20 c.c. of tenth normal acid, whereas from 50 to 60 c.c. must be added to the same quantity of cow's milk.

The prime essential of cow's milk modification for infant feeding, thus becomes, according to these authors, the reduction of buffers. The action of hydrochloric acid in the process of digestion is largely, if not entirely, due to the number of free hydrogen ions present. (It is for this reason that the determination of the hydrogen ion concentration is of more significance than the determination of the total gastric secretion by titration methods.) Milk, especially cow's milk, has the property, through its content of the buffer substance, of binding large amounts of acid and converting the hydrogen into a non-ionized form, thus rendering most of the hydrochloric acid secreted inactive, and greatly reducing the true acidity of the solution. The chief buffer substances are the phosphates and the calcium caseinate, substances capable of uniting with considerable quantities of acid or alkali, without undergoing any great change in chemical reaction.

Cow's sweet milk is capable of neutralizing to a great extent the acidity of the gastric juice, thus seriously impairing the normal digestive function. Sour milk, buttermilk, protein milk and whole lactic acid milk, all have the buffer value reduced toward that of human milk as a result of the formation of lactic acid. The same reduction may be accomplished by adding to whole cow's sweet milk some hydrochloric acid (Faber) and lactic acid (Marriott).

The addition of 25 c.c. of tenth normal hydrochloric acid to each hundred cubic centimeters of whole sweet cow's milk reduces the buffer value to approximately that of human milk (100 c.c. of human milk required, as stated above, from 15 to 20 c.c. of acid to bring it to the threshold of p_H 5.0, and cow's milk required from 50 to 60 c.c., namely, an additional 35 to 40 c.c. of tenth normal hydrochloric acid). This milk, with its reaction of p_H 6.0, too slightly acid to alter the taste, is taken by infants without protest.

The most striking and characteristic effect of hydrochloric acid milk feeding, as of protein milk feeding, is the appearance, usually within twenty-four or forty-eight hours, of smooth, grayish stools, consisting chiefly of calcium soaps.

The addition of lactic acid to cow's milk has a similar effect in reducing the buffer values. Lactic acid may be added to milk by souring with lactic acid organisms (from 0.5 to 0.7 per cent. lactic acid—with diminution in the sugar), or by the addition of lactic acid to sterilized milk. The latter is the method used by Marriott. He adds 1 dram (4 c.c.) of lactic acid, U. S. P. (from 75 to 85 per cent.) to each pint of milk (500 c.c.). A good grade of cow's milk is boiled for five minutes, then cooled and the scum removed. When slightly cool the lactic acid is dropped in slowly from a medicine dropper, while the milk is gently stirred. The taste and general physical properties are those of ordinary buttermilk.

The acidity of the lactic acid milk as thus prepared is p_H 4.0. That of the hydrochloric acid milk as prepared by Faber is p_H 6.0. Faber tried adding 50 c.c. of the tenth normal hydrochloric acid to each 100 c.c. of milk, which brings the threshold value to the assumed 5.0, but even at this degree of acidity the milk was found to have certain practical disadvantages, such as a rather sour taste, heavy flocculation of casein, refusal by some infants and failure (in one instance) to evoke the desired change in the stools. He found that merely reducing the buffer value to that of human milk, that is, using 25 c.c. of tenth normal hydrochloric acid as described in the foregoing, gave satisfactory results.

A further distinction between the two milks is seen in the different use of fats and sugars by the two advocates. Faber begins with a two-thirds whole milk formula, and in most instances within a few days uses a top 5 per cent. and a top 6 per cent. milk as a basis. Marriott used simply a good grade of any milk as a basis. Faber tried the milk chiefly on babies who suffered from sugar intolerance, and says that while acid did not appear to improve the digestion of sugar, it did not, apparently, render it more difficult, and in most instances it was found possible, after a suitable interval, to introduce sugar again into the formula after full recovery from the original disturbance. It was, however, found possible to obtain good gains in weight without addition of sugar, or with the addition of very small amounts, owing to the increased fat intake. (In one instance a mistake led to the administration of a formula containing nearly 8 per cent. of fat, without any ill effects.) Marriott says carbohydrate should be added to lactic acid milk, as the amount of sugar present (that of ordinary whole milk) is insufficient for the needs of the average infant. He considers the carbohydrate of choice is commercial corn syrup such as Karo, etc., obtainable at a grocery store, and recommends using 1 ounce to the day's feeding, and in some cases more.

Both milks are used without dilution. Hydrochloric acid milk is not recommended for young infants of less than 5 weeks of age, while lactic acid milk is used for premature and new-born infants (no dilution). Dilution is thought neither necessary nor desirable.

More than half of the children coming under observation during the last two years in the Washington University Dispensary have been fed on lactic acid milk and corn syrup mixtures, and the results in these infants have been appreciably better than in any other artificially fed group (Marriott).

Faber's argument for not using hydrochloric acid milk is as follows:

> During the first month or six weeks of life, as is well known, protein milk and lactic acid milk are not as a rule well borne. We have repeatedly found the reaction of colostrum (the first ten days) to be fairly alkaline, p_H 7.7. The

stomach of the new-born infant holds about 1 ounce, and it is estimated that with an intake of 3 ounces, two thirds of the milk has gone into the intestine by the time feeding is completed and before much change of reaction can have been produced in it by the gastric secretion. These facts appear to indicate that, in very young infants, proportionally much less digestion is gastric and more intestinal, the latter being optimal in an alkaline reaction. This may well point to the desirability of increasing the alkalinity of artificial food during the first month, lowering the buffer resistance to alkaline change, and may offer an explanation for the occasional usefulness of lime water. In any case, we have set a limit of six weeks of age as the earliest time at which acidified milk should be used.

Babbott [44] and his co-workers find that acid production and the hydrogen ion concentration increase with increase of age. Also, that the greater the gastric acidity, the more rapidly the stomach empties. The reaction of the stomach to food is complex. At least two factors stand out. First, there is a definite hydrogen ion concentration, an optimum acidity, toward which the organism strives. Davidsohn [45] has recently reviewed the significance of this acidity and its relation to peptic digestion. Babbott selects as the fact of importance that gastric secretion ceases when this acidity is attained. The other factor is the ability of the stomach to increase the acid secreted when more work is given it. The secreting capacity of infants is limited, so that when larger amounts of food or more concentrated foods are given, they are no longer able to reach the optimal acidity. In Babbott's series of cases the amount usually secreted could only be doubled. This is a small factor of safety.

Mulherin [46] says that acidified (lactic acid) milk with corn syrup is the food of choice when strictly artificial feeding has to be practiced; that it is an ideal food to use for complemental feeding when mother's milk is not wholly sufficient; that it is practically as digestible as mother's milk; that it can be beneficially fed to sick babies the same as to well babies, and that it is especially helpful to malnourished and marantic babies.

Tisdall and Brown [47] found the hydrogen ion concentration of the stools of normal new-born breast fed infants to be singularly constant, varying from 4.7 to 5.1. In artificially fed infants it varied from 4.6 to somewhat more alkaline than 8.3, though an acidity as great as p_H 4.6

44. Babbott, F. L.; Johnston, J. A.; Haskins, C. H., and Shohl, A. T.: Hydrogen-Ion Concentration of Gastric Contents of Infants, Am. J. Dis. Child. **26**:475 (Nov.) 1923.

45. Davidsohn, H.: Neuere Arbeiten zur Physiologie u. Pathologie der Magenverdauung beim Saugling, Arch. f. Kinderh. **69**:142 (April) 1921; Beitrag zur Physiologie u. Pathologie der Magenverdauung beim Saugling, ibid., **69**:239-244 (April) 1921.

46. Mulherin, W. A.: Acidified Milk with Karo Syrup as an Artificial Feeding for Babies, J. A. M. A. **82**:1811 (May 31) 1924.

47. Tisdall, F. F., and Brown, Alan: Studies on the Acidity (Hydrogen-Ion Concentration) of Infants Stools, Am. J. Dis. Child. **27**:312 (April) 1924.

was encountered in artificially fed infants only in severe diarrheal conditions. Butter soup feeding gave figures about 6.0; protein milk, cow's milk dilutions with added carbohydrates, and whole sour milk with added carbohydrates generally caused stools more alkaline than p_H 7.0. The degree of acidity of the stools was generally increased in the presence of parenteral infections.

From the present work and the work of others, the authors find that from the chemical standpoint the acidity apparently depends on the ratio, in the intestinal zone of fermentation, of the carbohydrate on one hand to the protein and base on the other. "The amount of carbohydrate in the zone of fermentation, apparently is influenced by the extent of the zone of fermentation, by the type of carbohydrate and by the state of health of the intestinal cells."

Earlier work by Eitel (1917), by Freudenberg (1921), and by Hess and Scheer (1921) was done with the electrometric method; the present work was done with the colorimetric method. The earlier work showed greater variations, even in breast fed infants.

In the discussion that has appeared concerning the merits of soured milk, Marriott [48] has emphasized the desirability of using lactic acid, an organic acid that may be completely burned in the body, rather than the inorganic hydrochloric acid. Hydrochloric acid is not burned in the body, it must be neutralized and excreted. The addition of 60 c.c. of tenth normal hydrochloric acid per hundred cubic centimeters of milk in the day's feeding would just about double the total acid content of the body, which must be cared for by the acid-base regulating mechanism. He finds lactic acid as effective in digestive processes as hydrochloric acid, and to have the advantage that it can be added in larger amounts. Others [49] write that too rapid delivery of acid contents into the duodenum may not always be desirable. Another [50] observes that results obtained in feeding infants are always largely dependent on one's ability to interpret the needs of the infant properly, and that most pediatricians are agreed that the average infant will make normal progress on a well-balanced simple milk mixture when a good quality of milk is used and the curd is broken either by boiling or alkalizing, with a reservation of acidified milk to meet special indications.

Flood [51] has studied the rate of sugar absorption in the new-born, using the Folin and Wu method of blood sugar determination, but

48. Marriott, W. McK.: Hydrochloric Acid Milk in Infant Feeding, J. A. M. A. **81**:242 (July 31) 1923.

49. Babbott, F. L., Jr.; Johnston, J. A.; Haskins, C. H., and Shohl, A. T.: Hydrogen-Ion Concentration of Gastric Contents of Infants, Am. J. Dis. Child. **26**:475 (Nov.) 1923; editorial, J. A. M. A. **82**:472 (Feb. 9) 1924.

50. Queries and Minor Notes, J. A. M. A. **82**:1066 (March 29) 1924.

51. Flood, R. G.: Rate of Sugar Absorption in the New-Born, J. A. M. A. **82**:1595 (May 17) 1924.

using only 2 c.c. of blood. Much work has been done with Bang's method, but this, he believes, is unreliable. With his modified method the inaccuracy was shown to be not more than 3.1 per cent. For newborn infants he found dextrose the most readily absorbed. Sucrose was not readily absorbed, but the ability to utilize the sugar increased with the age of the infant. The disaccharids show none of the characteristics of the component monosaccharids.

Freudenberg and Hoffmann [52] find the optimum hydrogen ion concentration for the action of the sugar splitting ferment is p_H 5.0, but they find a distinction between that from infants and that from cows, each acting better in whey from milk of its own species. These differences, they hold, may account for certain distinctions in artificially fed infants. The action is accelerated by phosphate ions and inhibited by calcium in different concentrations for each species.

OTHER SUBSTITUTE FEEDING

Brouwer [53] would allow the use of goat's milk in infant feeding only after the sixth month, believing that he finds a distinct causal connection between the early use of goat's milk and severe anemia in infants.

Blackham,[54] writing from an experience chiefly in hot countries, where satisfactory raw milk is difficult to obtain, advocates the use of milk powder for mixed feeding, giving the breast and following immediately by a bottle in which the amount of milk corresponds as nearly as possible to that in which the breast was deficient.

Milk-free diets for infants are discussed by Hamburger.[55] Calf's liver is recommended as an excellent source of protein and vitamins in such a diet. Cod liver oil and mineral salts are to be added, and fresh juice from fruits and vegetables.

Wiltschke [56] recommends a soup made from calf bone marrow for infants who do not take readily to mixed diet. Five grams of wheat grits are boiled for five minutes in 100 c.c. of water, and salted. Then 5 gm. of fresh red bone marrow from calves is added (preferably in gauze) and boiled for a few more minutes, the original volume of water being maintained. The mixture (100 c.c.) contains about 45 calories. Saccharine or sugar may be used to sweeten the broth.

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52. Freudenberg, E., and Hoffmann, P.: Lactose, Jahrb. f. Kinderh. **103**:21 (Sept.) 1923.
53. Brouwer, E.: Goat's Milk in Infant Feeding, Jahrb. f. Kinderh. **102**: 257 (July) 1923.
54. Blackham, R. J.: Cow's Milk in Infant Feeding, Brit. M. J. **2**:322 (Aug. 25) 1923.
55. Hamburger, R.: Infant Feeding Without Milk, Jahrb. f. Kinderh. **103**:277 (Dec.) 1923.
56. Wiltschke, F.: Bone Marrow Soup, Arch. f. Kinderh. **73**:241 (Dec. 18) 1923.

Eckert [57] writes on the maximum concentration of albumin in infant feeding, and quotes Pirquet as holding that the albumin concentration should be kept between 10 and 20 per cent. Obviously, two further important factors are the percentage of water and the absolute amounts of food ingested. Higher albumin concentrations endangered digestion in the eight healthy infants tested, and caused a marked decrease in weight.

Paul [58] finds that dyspeptic stools may occur in cases of intestinal fermentation with acid bowel movements, and also with alkaline bowel movements, suggesting that the two processes, fermentation and putrefaction, go on simultaneously. As putrefaction in the intestine is associated with an increase of indican in the urine, he would use a determination of this as an index of predominance of putrefaction in the intestine, and thus be guided in increasing the carbohydrate. In patients with dyspeptic stools, stationary weight and indicanuria, he increased the carbohydrate, and increase in weight, improved general condition and return to normal bowel movements followed.

Schaps [59] says that daily addition of from 2 to 3 gm. of lactic acid, administered in 5 or 6 doses, arrests dyspepsia in a few days, whether it be fermentative or putrefactive in origin. He advocates the use of from 10 to 20 gm. of gelatin in a liter of water during the day in patients with severe habitual vomiting and intestinal intoxication.

Frontali [60] observed that petroleum benzin extracts from dilutions of cow's milk remained fluid at 41 C., while the extracts from the feces of infants fed with the same milk were solidified. From this he concluded that the absorption of the more liquid fats is easier, and recalling that olive oil is used in Italy with good results instead of butter fat in infant feeding, he made this substitution. He found the more fat he substituted with oil the better was the absorption. He obtained the best absorption (96.75 per cent.) with a gruel composed of skim milk, 500 parts; water, 500; olive oil, 40; flour, 40, and sugar, 45 parts. The olive oil was well borne, even in early infancy, but good results were not obtained in severe atrophy and nutritional disturbances.

By adding the yolk of one raw egg to the daily formula of infants in December, Hess [61] was able to protect twelve from rickets, and also

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57. Eckert, M.: Concentrated Albumin in Infant Feeding, Ztschr. f. Kinderh. **37**:1, 1924.

58. Paul, S.: Concerning the Technic of the Use of Protein Milk, Monatschr. f. Kinderh. **27**:504 (Feb.) 1924.

59. Schaps: Pathology and Treatment of Nutritional Disturbances, Jahrb. f. Kinderh. **101**:315 (April) 1923.

60. Frontali, G.: Olive Oil in Infant Feeding, Riv. di Clin. Pediat. **22**:145 (March) 1924.

61. Hess, A. F.: The Therapeutic Value of Egg Yolk in Rickets, J. A. M. A. **81**:15 (July 7) 1923.

to prevent the level of the inorganic phosphates of the blood from falling from the level encountered in summer. He concluded that egg yolk possesses marked antirachitic properties for infants, and for that purpose can be recommended as a supplement to the dietary comparable to orange juice in the protection against infantile scurvy. As its curative value is lower than that of cod liver oil, it should not be relied on for the cure of rickets except when the oil is not well borne. It should be remembered also that the yolk of egg is exceptionally rich in iron.

Reyher [62] found that changing infants from milk of cows fed on green fodder to milk of those fed on dry fodder caused cessation in the gain in weight with surprising constancy. He attributes this to lack of one or another vitamin, and says diarrhea has been rare in an institution since he has been investigating the possibility of lack of vitamins in every case.

Epstein [63] reports on the action of nonspecific serum therapy in severely atrophic infants. Injections of serum from animals given daily avoided anaphylactic phenomena, and he noticed good results in twelve out of eighteen cases. He started with 0.5 c.c., and added daily from 0.2 to 0.3 c.c., until the optimum was reached (between 1 and 2 c.c.); in some cases 30 injections were necessary. The treatment seemed to act on the hydration function of infantile tissue.

Jones [64] reports that he found the hemoglobin and the number of red cells increased markedly in animals fed with germinating oats, the increase being attributable to ingestion of vitamins.

62. Reyher, P.: Nutritional Disturbances of Infants, Klin. Wchnschr. **3:** 213 (Feb. 5) 1924.

63. Epstein, B.: Nonspecific Serum Treatment in Infancy, Monatschr. f. Kinderh. **25:**72 (March 25) 1923.

64. Jones, K.: Vitamin and the Blood, Monatschr. f. Kinderh. **26:**545 (Sept.) 1923.

(To be continued)

CORRECTION

Diphtheria: A Review of the Literature for 1923.—Dr. Howard Osgood, Buffalo, calls attention to the fact that an error occurred in the abstract of his article incorporated in this review, in the March issue of the AMERICAN JOURNAL OF DISEASES OF CHILDREN. Dr. Crooks, author of the review, states that the twenty-eighth line on p. 394 should read: "The physiologic sodium chlorid solution did not lower the percentage of chills."

Abstracts from Current Literature

Anatomy and Physiology

THE BIOCHEMISTRY OF THE GRANULATED LACTIC ACID BACTERIA FROM CEREAL. E. B. FRED, W. H. PETERSON and H. R. STILES, J. Bacteriol. **10**:63, 1925.

From 50 pure cultures of the granulated lactic acid forming bacilli, isolated from fermenting cereal decoctions, four were selected for detailed study. The general cultural characteristics, as well as qualitative and quantitative fermentation of various sugars and related compounds, were determined.

These organisms were found to be closely related to the group of bacteria known as *Lactobacillus delbrücki.* The authors place them in the species *Lactobacillus leichmani* (Henneberg).

The following sugars were found to be readily fermented: glucose, fructose and mannose. Galactose was fermented more slowly. The disaccharids were attacked to a lesser degree and the trisaccharids scarcely at all. Considerable acid was formed from glucosids and dextrin.

Lactic acid was the major product of fermentation, only traces of volatile acid, alcohol and carbon dioxid being found.

WESTLUND, Chicago.

URIC ACID DETERMINATIONS IN BLOOD. FREDERICK M. R. BULMER, BLYTHE ALFRED EAGLES and GEORGE HUNTER, J. Biol. Chem. **63**:17, 1925.

When uric acid determinations are made by adding the uric acid reagent directly to the blood serum which has been freed of protein (Benedict method), considerably higher results are obtained with blood from rabbits, dogs, cats, guinea-pigs and oxen than when the longer method is used, where uric acid is precipitated with silver lactate before the reagent is added (Folin method). The same difference is found in varying degrees, when human blood is analyzed by the two methods. The authors believe the higher results with the Benedict method are due to the presence of some other substance in the blood which reacts with the uric acid reagent. They feel that such direct methods are unreliable.

HIGGINS, Cincinnati.

EXPERIMENTAL ALTERATION IN THE CALCIUM CONTENT OF HUMAN SERUM AND URINE. C. B. STEWART and J. B. S. HALDANE, Biochem. J. **18**:855, 1924.

The calcium content of human serum can be raised from 10 to 20 per cent. by ingestion of calcium chlorid or ammonium chlorid, by breathing from 6 to 7 per cent. carbon dioxid, or by forced breathing. It can be lowered from 10 to 20 per cent. by ingestion of sodium bicarbonate. The urinary calcium output is increased by ingestion of ammonium chlorid and is little affected by sodium bicarbonate.

KUGELMASS, New Haven, Conn.

INVESTIGATIONS OF BISMUTH SALTS. SVEND LOMHOLT, Ugesk. f. Læger **7**:141, 1925.

During the last two years, bismuth salts have become very important in the treatment of syphilis. The author thinks that unfortunate fatalities, such

as have resulted in a few instances, may be avoided only through a study of the speed of absorption and excretion of these salts.

He reports a series of experiments on rabbits in which he used bismuth-quinin-iodid and bismuth-hydroxid. These salts are very similar to those of mercury in their absorption, distribution in the body, and excretion, except that there is generally a greater concentration of bismuth in the kidney than in the liver, the reverse being true in the case of mercury. The local reaction, set up in the muscle tissue, and the accompanying pain are much less with bismuth compounds than with mercury. Absorption is very slow, so that ten days after the injection three-fifths of the dose of bismuth-quinin-iodid still remains unabsorbed; but this may be due in part to the complex compound. Excretion is also slow, inasmuch as after ten daily injections, only from 15 to 20 per cent. of a single dose is excreted daily. It is probable that with bismuth, as with mercury, encapsulation of the injected area takes place, and if several of these areas should coexist and simultaneously rupture, serious consequences would result. The author thinks that, in view of this slow absorption, much too large doses have been used.

INVESTIGATIONS OF THE MULTIROTATIONS OF β GLUCOSE UNDER DIFFERENT CONDITIONS. CHRISTEN LUNDSGAARD and SVEND AAGE HOLBØLL, Ugesk. f. Læger **8**:169, 1925.

In earlier papers (*Ugeskrift for Læger*, **86**:591 [Aug. 7], 693 [Sept. 18] 1924), the authors showed that the specific rotation value of glucose after addition of fresh muscle tissue and insulin was too low to account for all the sugar found by reduction; so they assumed that some other form of glucose (γ glucose) was responsible for the marked difference. This assumption has been criticized because Lundsgaard and Holbøll did not show a specific rotation of the solutions used lower than β glucose and, therefore, were not justified in concluding that γ glucose was produced by muscle tissue in the presence of insulin.

In the present paper, the question of γ glucose formation is attacked from a different angle. The specific rotation of glucose in distilled water is noted and plotted for various p_H values and intervals of time. These findings are then compared with those of a solution containing glucose, muscle tissue and insulin treated similarly, and the following conclusions drawn: (1) The differences found cannot be explained as being due to a stabilizing influence of muscle tissue and insulin upon β glucose, because an equilibrium of γ-β glucose results just as rapidly as in the glucose-water solution; (2) there is no evidence, therefore, of an increase of β glucose but evidence of a new form of sugar with a low specific rotation; and (3) this new form of glucose, while it may not be γ glucose, contains a free aldehyd group, and should be designated as "new glucose."

SCHLUTZ, Minneapolis.

Pathology, Bacteriology and Biochemistry

A NEW OR DELTA TYPE STREPTOCOCCUS. CARRIE KIRK BRYANT, J. Bacteriol. **10**:53, 1925.

A new type of streptococcus, isolated from the root canals of pulpless teeth, is described. This organism does not fall into any of the four groups outlined by Brown (1919). The colonies on blood agar resemble Brown's alpha type, as they are surrounded by a greenish zone in which the blood cells persist but without their normal color. They differ from the alpha type in that no

outer zone of hemolysis is formed on refrigeration. There is, moreover, no decrease in the number of blood cells in the zone surrounding the colony.

WESTLUND, Chicago.

PLASMA LIPOIDS IN EXPERIMENTAL ANEMIA. W. R. BLOOR, J. Biol. Chem. **63**:1, 1925.

Large amounts of blood were withdrawn frequently from normal dogs; anemia was produced, the corpuscles occupying from 15 to 20 per cent. of the total blood volume. The lipoid content of the blood from these anemic dogs was compared with that of normal dogs.

The lipoids of the blood of the anemic dogs was greater in amount and also consisted of a higher proportion of the unsaturated fatty acids. This is in agreement with the findings in anemia of human patients.

It would appear that lipemia is the result and not the cause of anemia. The lipemia may be due to displacement of fat in the bone marrow by regenerating blood-forming tissue.

ON THE MECHANISM OF WATER INTOXICATION. FRANK P. UNDERHILL and MYRON A. SALLICK, J. Biol. Chem. **63**:61, 1925.

This is a chemical study of the blood and urine in water intoxication. Large amounts of water (50 c.c. per kilogram of body weight) were given every half hour by a stomach tube to a dog. Symptoms of toxicity — restlessness, salivation and vomiting — occurred when an amount of water equivalent to one third of the body weight had been given, and the more pronounced symptoms — ataxia, muscular twitchings, convulsions and coma — when the amount reached two thirds of the body weight. The animals usually recovered quickly. The cause of the intoxication seems due to disturbance of the water-salt equilibrium of the body, as manifested by diminution of the salt content of the blood and increased elimination of salts during the period of the giving of the fluids.

A STUDY OF THE PHOSPHORUS, CALCIUM AND ALKALINE RESERVE OF THE BLOOD SERUMS OF NORMAL AND RACHITIC CHICKS. C. W. ACKERSON, M. J. BLISH and F. E. MUSSEHL, J. Biol. Chem. **63**:75, 1925.

Rickets was produced by controlling the diet of white Leghorn chickens. The inorganic phosphorus and the calcium of the blood serum was determined in normal birds and in the rachitic birds. The results are given in the following table:

	Normal		Rachitic	
	No. Birds	Mg. per 100 C.c.	No. Birds	Mg. per 100 C.c.
Calcium	56	10.61	68	4.70
Phosphorus	51	7.49	66	3.91

The plasma bicarbonate was unchanged in the rachitic chickens.

The theory of Howland and Kramer, that when the product of the concentration of inorganic phosphorus into the calcium expressed in terms of milligrams per hundred cubic centimeters of blood serum is above 40, rickets is either healing or absent, is confirmed for chickens.

HIGGINS, Cincinnati.

Nutrition

TWO YEARS PRACTICAL EXPERIENCE WITH THE QUARTZ LIGHT IN CHILDREN'S DISEASES. JOHN ZAHORSKY, J. Missouri State M. A. **22**:61, 1925.

The author summarizes the effects of chemical rays of light.

He has used the quartz light in nearly 200 cases of various local and general diseases. No bad results have been obtained and only a few patients had "burns."

His cases are divided into a number of groups for which he gives his results. These are:

Group 1.—Superficial infections. Furunculosis not favorable. Impètigo no more so than with chemical germicides. Ringworm cleared up more rapidly. Erysipelas, excellent results.

Group 2.—Rickets and spasmophilia. In rickets the results are not so striking as on exposure to the open sunlight. Spasmophilia, good results.

Group 3.—Tuberculosis, results generally good.

Group 4.—Chronic bronchopneumonia, generally improvement.

Group 5.—Chronically infected tonsils, results not striking; but in bronchial adenopathy improvement in nutrition was often remarkable.

Group 6.—Otitis and vaginitis. In otitis it is helpful at times, in specific vaginitis a failure.

Group 7.—Skin diseases, acne, eczema, etc. Results generally good.

Group 8.—Malnutrition. Some patients markedly improved even by two treatments, but not enough have been studied.

On the whole, the quartz light is regarded as a valuable addition in therapeutics, but generally it can be replaced by the open sunlight in the summer months.

SCHORER, Kansas City, Mo.

THE DIETETIC VALUE OF BARLEY, MALT AND MALTED LIQUORS AS DETERMINED BY THEIR VITAMIN CONTENT. H. W. SOUTHGATE, Biochem. J. **18**:769, 1924.

Barley and malt contain water-soluble B, judged by the effect on rats. Malt also prevents and cures polyneuritis in pigeons when used in conjunction with the same basal diet as was used in experiments on growth in rats. There is no appreciable amount of any other accessory food factors in barley.

THE MINERAL CONTENT OF HUMAN MILK IN NORMAL AND RACHITIC FAMILIES. S. V. TELFER, Biochem. J. **18**:809, 1924.

The mineral content of twenty-seven specimens of breast milk of women living under poor conditions in the industrial quarters of Glasgow was determined. No appreciable differences were found in the composition of milks, whether the infants developed rickets or not. The fat content of several specimens of both groups was abnormally low. Twelve specimens of milk from women living in the country were examined for comparison. In these, the ratio of phosphorus to calcium was higher than in the milks of women living in the poor environments. Schabad's conclusion that infantile rickets may develop on breast milk with a high calcium content is thus confirmed.

THE CALCIUM METABOLISM OF ATROPHIC INFANTS AND ITS RELATIONSHIP TO THEIR FAT METABOLISM. EVELYN M. HICKMANS, Biochem. J. **18**:925, 1924.

Atrophic infants can absorb calcium as well as normal infants, and in many cases can absorb larger amounts per kilogram of body weight than is absorbed by

normal children. In atrophy an ample intake of fat and calcium is beneficial. When the fat content is low and the calcium content is high, the absorption of calcium may reach a low level with a negative calcium balance. Calcium output depends on calcium intake but more so on the fat intake. Fat intake should not be less than from 12 to 14 gm. daily. The best absorption takes place when there is a definite relation between the fat and calcium intake, from 0.04 to 0.078 gm. calcium monoxid for every gram of fat in milk-water mixtures. The absorption is also good when calcium monoxid is as high as 0.12 gm. in certain dried milk mixtures. The average percentage of absorption of calcium monoxid for forty-eight cases was 43, but it varies with different diets. The actual weight of calcium monoxid absorbed varied from 0 to 1.7, with an average of 0.43 gm. in twenty-four hours. The amount of calcium monoxid absorbed per kilogram of body weight varies from 0 to 0.33 gm. with an average of 0.12 gm. To ensure an absorption of 0.1 gm. per kilogram of body weight, the fat intake must be between 2 and 6 gm. per kilogram of body weight.

KUGELMASS, New Haven, Conn.

THE CONSTITUTION IN ITS RELATION TO NUTRITION. B. P. B. PLANTENGA, Arch. de méd. d. enf. **27**:651 (Nov.) 1924.

The author believes that the hereditary factor is the basis of all of the constitutional deviations or diatheses. The practical value of the usual classification of the diatheses is decreased by the frequent difficulty in differentiating between the various forms. The author has endeavored to study these conditions from the standpoint of their relationship to certain food factors. He uses the term, constitutional disharmony, to differentiate these deviations from the normal as compared with the term, constitutional harmony, for the normal. Constitutional disharmony gives different reactions dependent on the quality and quantity of the simple foodstuffs and on their correlation with other substances. This classification makes the groupings distinct as to their clinical symptoms and makes it possible to determine the causative factor. In disharmony to fats, the hereditary antecedents consist of a great tendency to infection (rhinitis, otitis, bronchitis, pneumonia, etc.), with a later tendency to glandular hypertrophy, adenoid vegetations, eczema and tuberculosis. The symptoms consist of increase in weight and tranquillity on low food intake, with a disposition to infections and eczema. When the mother takes much fat, the nursing infant quickly develops eczema. Restriction of fats in the maternal diet or restriction of fats in the artificially fed, by giving buttermilk or skim milk, results in a rapid disappearance of symptoms. In the disharmony to protein the hereditary antecedents resemble those of the neuro-arthritic diathesis. The extremities of the infants are more or less cyanosed and cold, the skin is pale and the infants are irritable and cry much. There is a tendency to geographic tongue, red buttocks and intertrigo. Growth is slow even though the infants eat well, and gastro-intestinal disturbances frequently follow slight increase in the diet. On an increase of the animal or vegetable fats with a reduction of the protein, the symptoms improve. In the case of disharmony to carbohydrates besides the history of neuro-arthritic manifestations in the family, there is often a history of neurasthenia, mental deficiency and alcoholism. The symptoms are not well defined. The infants do not gain well, are pale, and show a tendency to gastro-intestinal disturbances. Increase of carbohydrates either directly to the diet or by way of the maternal diet aggravates

the symptoms. In the disharmony to salts, there are no striking hereditary manifestations. The infant is sensitive to climatic influences, external irritation and emotions, and is of the spasmophilic type. Treatment consists in reduction of the salts. Disharmony to eggs, cocoa, fruits, some vegetables and some insect bites may coincide with several of the foregoing forms and usually manifests itself in urticaria.

NEW OBSERVATIONS OF INFANTILE SCURVY. JULES COMBY, Arch. de méd. d. enf. **28**:1 (Jan.) 1925.

The author discusses the subject of infantile scurvy thoroughly and gives the details of ninety-two personal cases. In all of these, refined foods had been used over prolonged periods of time. All but five of the children were under 18 months of age. Painful pseudoparalysis and gingival hemorrhage were the outstanding symptoms. The former occurred 88 times, and in four of the instances in which it was not present, the children were over 3½ years. Gingival hemorrhages were found 65 times, and almost exclusively involved the upper jaw. Children without teeth did not show these hemorrhages. Fever occurred in twelve patients and was usually moderate. Subperiosteal hemorrhages were observed in ten, cutaneous and subcutaneous hemorrhages in ten, and hematuria in two children. Errors of diagnosis are now less common because of the publicity given this disease. The prognosis is favorable, unless the diagnosis is made too late. Treatment consists of replacing the refined food substances with fresh milk, orange or lemon juice. It is to be noted that the withdrawal of the refined foodstuffs and substitution of foods rich in vitamin C is more efficacious than the simple addition of these fruit juices.

STATE OF SHOCK IN A NURSING INFANT FROM INGESTION OF ALBUMIN. CONDAT, Arch. de méd. d. enf. **28**:36 (Jan.) 1925.

A nursing infant, aged 5 months, who had previously manifested facial eczema developed mild diarrhea. On the advice of a neighbor the mother administered albumin water. Two hours later typical symptoms of anaphylactic shock appeared, which were followed a short time later by a generalized urticarial eruption. This case was exceptional, as it was an instance of anaphylactic shock of first injection rather than one of re-injection.

BONAR, Salt Lake City.

PATHOGENESIS OF GOAT MILK ANEMIA. H. BEUMER and G. WIECZOREK, Jahrb. f. Kinderh. **107**:311, 1924.

Young dogs were used as experimental animals. On goat's milk the dogs soon became anemic, the lowered hemoglobin being evident in a week, and dropping about 20 per cent. in a month. When added to skimmed cow's milk, goat milk cream caused a rapidly developing anemia, so that the anemia producing factor is probably in the cream. It is supposed that this factor is the lower fatty acids, such as caproic acid. Addition of cereal lessened or neutralized the injurious effect of goat's milk. This observation has not been tested clinically.

PATHOGENESIS OF ACUTE NUTRITIONAL DISTURBANCES IN INFANCY. FRITZ SILBERSTEIN and GRETE SINGER, Jahrb. f. Kinderh. **107**:329, 1925.

This is an attempt to explain the apparent etiologic importance of *B. coli* in nutritional disturbances. Cultures of *B. coli* from infants with normal

gastro-intestinal function, and cases of diarrheas and intoxication, after growth in a milk derivative, were added to a contracting strip of guinea-pig intestine according to the Magnus method. *B. coli* from normal infants affected the intestinal strip if they had been incubated from seventeen to ninety hours in the milk product. Strains from infants with dyspepsia or intoxication showed this maximum action after a shorter growth period. Strains grown in mediums to which albumin fat or carbohydrate had been added showed changes in their biologic characters, but not sufficient to allow the formulation of generalizations. Cultivation with extremes of sugar or fat in the mediums acted differently with different strains. In general, *B. coli* from the normal stool were little influenced by the carbohydrate. Fat excess of the mediums gave the maximum increase of tonus and peristalsis. Intoxication strains were especially sensitive to both abnormalities of the food. In the first hours of the growth, there was a paralyzing effect on the tonus and peristalsis, while later the pressor effect predominated. In the intact intestine, the former effect would lead to paralysis and retention of the toxic material and the later effect would cause cramps.

SUTHERLAND, Chicago.

THE TREATMENT OF ACUTE GASTRO-INTESTINAL DISORDERS IN INFANTS. E. ENDERLEIN, München. med. Wchnschr. **71**:1131, 1924.

The treatment of severe, acute gastro-intestinal disorders of infants is started with a carrot soup, containing no meat broth and less salt and carrots than that of Moro.

HEMATOMA OF THE BONE MARROW IN A RACHITIC, SYPHILITIC INFANT, F. J. LANG, München. med. Wchnschr. **71**:1463, 1924.

Hematomas of the bones were found in the diaphyses of femur and tibia of a boy, aged 10 months, with signs of rickets and suspicion of syphilis.

REVIEW OF THE RESULTS OBTAINED WITH CONCENTRATED MILK SUGAR IN THE OSNABRUCK HEBAMMENSCHULE, FROM APRIL 1 TO JULY 1, 1924. ARNOLD BUNNEMANN, München. med. Wchnschr. **71**:1644, 1924.

In cases where the amount of breast milk was insufficient, supplementary feeding of new-born infants within the first three to six weeks of life with whole milk to which 17 per cent. cane sugar had been added proved very efficient.

METABOLISM OF CHILDREN WITH FEVER. W. BIRK, München. med. Wchnschr. **71**:1745, 1924.

The paper is concerned with metabolism studies in cases of fever associated with vaccination, chickenpox and measles. In vaccination fever there was a diminution of nitrogen retention, as well as of mineral substances with the exception of phosphorus pentoxid. In the reconvalescence the retention increases, with the exception of sodium. Only chlorin exceeds its prefebrile retention. In the case of chickenpox, a period preceding the fever showed variations in the nitrogen retention. During the fever chlorin, sodium and potassium show an increased retention, as does also phosphorus pentoxid, if small. Much nitrogen is lost. During convalescence the nitrogen retention oscillates with an occasional negative balance. Otherwise, conditions are about as in the prefebrile period. Measles also has a prefebrile period, show-

ing a negative sodium balance and much diminished magnesium retention while chlorin retention is increased. The nitrogen retention is markedly increased in the prefebrile period. During the fourth period, where the temperature is still above normal, the retention of mineral substances is increased. It is evident that there are changes of the metabolism in infectious diseases independent of the rise of temperature and that the metabolism of convalescence differs from the normal metabolism.

AMBERG, Rochester, Minn.

Prenatal Conditions

FACIAL HEMIHYPERTROPHY. ANDRÉ LÉRI and SATRE, Arch. de méd. d. enf. **27**:747 (Dec.) 1924.

The authors report a case of simple hemihypertrophy of the right side of the face in a girl, aged 5 years and 10 months. The asymmetry was noticed from birth and had continued in nearly the same proportions. The hypertrophy commenced below the orbits, involving the malar, superior and inferior maxillary bones and the adjacent soft tissues. The extreme precocity of evolution of the teeth on the involved side was particularly interesting. The dentition of the right side was systematically from three to four years in advance of normal dentition and of that of the left side.

BONAR, Salt Lake City.

CONGENITAL EDEMA. GOORMAGHTIGH and VAN CAUWENBERGHE, Bruxelles med. **5**:412 (Jan. 18) 1925.

Necropsy showed changes in the blood-producing and other organs analogous to those of leukemia, except that the excessive production was of erythrocytes. Goormaghtigh and Cauwenberghe ascribe the anomaly to tuberculosis in the parents.

[J. A. M. A.]

INJURY OF THE FETUS BY ROENTGENOTHERAPY. H. NAUJOKS, Monatschr. f. Geburtsch. u. Gynäk. **68**:40 (Dec.) 1924.

The author emphasizes the fact that theoretic conclusions and annual experimentation help very little in solving this complicated problem.

He reports in detail a case; the child was born after postoperative treatment for ovarian sarcoma by roentgen ray early in pregnancy. The child was born easily, there was no evidence of syphilis; other children born before and after the patient were normal. The patient was a typical microcephalic idiot.

He concludes that in this case, the reasonable diagnosis is injury to the child from roentgen-ray treatment of a pelvic tumor in the mother during pregnancy.

CROTHERS, Boston.

Diseases of the New-Born

A STUDY OF PNEUMONIA IN THE STILLBORN AND NEW-BORN. W. C. JOHNSON and J. R. MEYER, Am. J. Obst. & Gynec. **9**:151 (Feb.) 1925.

The authors found an incidence of 19.4 per cent. of pneumonia in a series of 500 necropsies. The list includes viable and nonviable, new-born and stillborn infants.

The cases are listed in four groups as follows: (1) Antenatal infection, antenatal or intranatal death, thirty cases; (2) probable antenatal or intrapartum infection; death usually within three days after birth, thirty-eight cases; (3) pneumonia with hyaline membrane (type of asphyxia neonatorum), eight cases; (4) postnatal infection, twenty-one cases.

It was found that practically all of the sixty-eight cases in Groups 1 and 2 were due to infection of the amniotic sac and aspiration of infected amniotic fluid. They were essentially "congenital pneumonias."

A diagnosis could rarely be made from the gross appearance of the lung, but on microscopic examination, practically all of the alveoli throughout the lung were affected. The diffuseness of the reaction depends on the primary atelectasis. The elements of the infected amniotic fluid were scattered through the exudate everywhere. The most characteristic of these were the epidermal cells, desquamated from the fetal skin, and the authors give their methods for staining amniotic fluid components. Bacteriologic study was not complete or satisfactory, but in the stained slides twenty-eight out of the sixty-three cases in Groups 1 and 2 were positive for bacteria, usually gram-positive cocci, suggesting staphylococci and streptococci; gram-positive and gram-negative bacilli were also found, but no pneumococci. The most important clinical fact in these cases was that the majority gave a history of premature rupture of the membranes. In Group 1 the placenta and membranes were examined in thirteen cases and eleven were found to be acutely inflamed. In Group 2 out of nine cases, only one was normal and six were inflamed; two showed syphilitic changes. The physical signs were meager and inconstant; the most frequent were cyanosis and difficult respiration. In most cases there was no fever.

Group 4, or pneumonia with "hyaline membrane," was probably due to aspiration of amniotic fluid early enough in the antenatal period for the constituents to undergo hyaline degeneration. The children usually breathed spontaneously, but later began to have attacks of increasing cyanosis and dyspnea. The usual diagnosis is hypertrophy of the thymus or atelectasis. The authors feel that a true hypertrophy of the thymus is rare and were unable to find a convincing case in the series of 500 necropsies.

The postnatal infections were mostly in premature infants, occurring in fifteen out of twenty-one. The clinical histories seem to indicate infection from aspiration of food, either after regurgitation or during gavage feeding.

REPORT OF TWO HUNDRED AND TWENTY-FOUR CASES OF IMPETIGO IN THE NEWBORN. H. S. MCCANLISH, Am. J. Obst. & Gynec. 9:228, 1925.

The report covers an outbreak of impetigo at Bellevue Hospital, New York. Only the first three patients died; a mortality of 1.3 per cent. The first two died at ten days and two weeks respectively, when the lesions were healing. The other death occurred after the infant had been taken home against the attendant's advice.

All cases were of the so-called vesicular and exfoliative forms. *Staphylococcus pyogenes aureus* was the predominating organism.

No definite source for infection could be determined, but the disease has a self-limiting course and the general health of the infant is usually but little affected. Death probably occurs in those children with marked exfoliation and secondary infections.

The best method of treatment found was to paint the affected areas with sterile liquid albolene and to use aseptic dressings, in order to prevent rupture of the vesicles with consequent autoinoculation.

ALLEN, Chicago.

PRIMARY HYPERTROPHY OF THE GUMS. S. D. RUGGLES, J. A. M. A. **84**:20 (Jan. 3) 1925.

A search of the literature reveals but few reported cases of this disease, which is undoubtedly congenital in some cases. Two patients with this condition are reported, in one of which the hypertrophy was noticed at birth. Treatment consisted of radical alveolotomy.

BONAR, Salt Lake City.

THE RELATIVE LOSS OF HEAT AND WEIGHT IN THE NEW-BORN, AND THE TREATMENT OF SHOCK. A. LOUISE MCILROY, Brit. M. J. **1**:67-68, 1925.

The author, at the suggestion of Professor Pembrey, carried out a series of observations extending over a period of nine months, in which she demonstrated that the weight loss apparently was closely associated with heat loss in the new-born infant. The usual method of bathing was discarded and all infants were oiled instead, at the same time seeing that they were adequately protected by heat, by means of hot blankets and bottles, etc. The oiling was continued till discharge from the hospital, when the mother was shown the procedure in giving the first bath. Comparing this method with a series of controls, bathed in the usual manner, a definite reduction in the initial weight loss among the former was shown. It should be noted that infants properly oiled may be kept just as cleanly as those washed in the usual manner.

Regarding shock in the new-born, the author distinguished "blue asphyxia" from "white asphyxia," the former being relieved by the suction of mucus from the air passages, accompanied by the usual methods of resuscitation; while in the latter, in which the condition is due to cranial compression during difficult labor or pressure on the umbilical circulation, the treatment should be quite different and should be directed to the cardiac failure which is the direct outcome of the "white asphyxia." In this latter condition the baby should be handled with the greatest care, the air passages, of course, should be cleared and then the infant put to rest in a cot, gentle massage of the heart should be carried out under the blanket accompanied by the use of stimulants such as camphor. Time, warmth and rest are the important points to observe in this alternative treatment, which has been shown to produce superior results to the more vigorous methods hitherto employed.

BROWN, Toronto.

DIARRHEA OF THE NEW-BORN TREATED WITH SODIUM CITRATE. ADAN CUADRA, Arch. de méd. d. enf. **27**:676 (Nov.) 1924.

In new-born infants suffering from colic and diarrhea with curdy stools, good results were obtained by the administration of sodium citrate.

BONAR, Salt Lake City.

Acute Infections

IGNORANCE AND NEGLIGENCE AS FACTORS IN DEATHS FROM DIPHTHERIA. E. C. FLEISCHNER and E. B. SHAW, Arch. Pediat. **42**:25, 1925.

For an analysis of the factors responsible for preventable deaths in diphtheria, the authors have divided them into three main groups, with further subdivision. These factors are: 1. Delayed diagnosis due to ignorance and negligence of parents in not seeking medical aid sufficiently early. 2. Errors and delays on the part of the attending physician in making the diagnosis. 3. Errors and delays in treatment. Every death from diphtheria is preventable and avoidable. If this is true, the enormous number of deaths each year must be attributed either to ignorance or negligence. Intensive education of the layman and conscientious study on the part of the medical adviser will do much to combat this lamentable situation.

VON MEYSENBUG, New Orleans.

INTRADERMAL SALT SOLUTION TEST IN SCARLET FEVER AND DIPHTHERIA PATIENTS. WILLIAM J. BAKER, J. A. M. A. **83**:1566 (Nov. 15) 1924.

Using the technic for the intradermal salt solution test, as outlined by McClure and Aldrich, an effort was made to determine whether there is any reduction in the disappearance time of intradermally injected salt solution in seventy scarlet fever patients and thirty diphtheria patients. Taking the normal disappearance time of sixty to ninety minutes, they found that it was reduced in patients with scarlet fever and diphtheria, the reduction running parallel with the severity of the intoxication. The test is of aid in indicating the condition of the patient and in predicting the outcome. Their observations seem to indicate that the reduced disappearance time does not directly parallel the extent of renal injury.

THE SYMPTOMATOLOGY OF MEASLES MODIFIED BY LATE SERUM IMMUNIZATION. JOSEPH C. REGAN, J. A. M. A. **83**:1763 (Nov. 29) 1924.

The author calls attention to a type of modified measles induced by late serum immunization. In a series of fifteen children exposed, who were injected during the incubation period, the disease was modified in several ways. The incubation period showed a tendency to be longer while the period of invasion was shortened. Coryza was either absent or mild. Koplik's spots were usually absent or were atypical in evolution and the exanthem was lacking. Prodromal rashes occurred with greater frequency. The eruption was scant or atypical and in most cases became ecchymotic as it faded. The temperature curve was lowered, the constitutional reaction less pronounced and complications practically lacking. It was concluded that measles convalescent serum administered late in the incubation period, between the sixth and ninth day, in dosages of from 8 to 10 c.c., induced a modified measles, with mild symptoms, lack of complications and shortened duration. The following facts favor the late administration of serum to induce this form of the disease: (1) the exposure may be known in one instance but unknown in the next; (2) the immunity conferred by an injection early in the incubation is probably entirely passive in type; (3) the supply of serum is too limited for repeated immunizations of the same child. The author believes that with the exception of institutional cases and of children under 2 years of age, or older patients

suffering from debilitating diseases, the late immunization of susceptible persons is by far the more logical.

A Study of the 1923 Epidemic of Anterior Poliomyelitis in Kansas. Rex L. Dively, J. A. M. A. **84**:85 (Jan. 10) 1925.

From the study of this epidemic the author is led to believe that definite poliomyelitis carriers exist during the epidemic. It would also seem that the disease is selective to certain individuals. He concludes that: if an early diagnosis is made, and proper treatment instituted during the febrile stage, the resulting cord involvement is not only lessened but in a great percentage of cases prevented; if proper treatment is carried out during the convalescent stage, marked improvement or complete recovery will occur in from 75 to 85 per cent., against 40 to 45 per cent. if proper treatment is not carried out; and if proper treatment is carried out during the first and second stages, fully 90 per cent. of the deformed limbs and backs can be prevented. Many patients recover spontaneously without treatment, while others still show signs of paralysis after one year of careful supervision.

Serum Prophylaxis of Epidemic Parotitis. Joseph C. Regan, J. A. M. A. **84**:279 (Jan. 24) 1925.

Convalescent serum immunization against epidemic parotitis was attempted in two small exposed groups of children in a contagious disease hospital. The results seemed to show that convalescent parotitis serum possesses the property of immunizing exposed susceptible individuals. The serum should be injected in dosages of from 2 to 4 c.c., before the seventh day after exposure to afford complete immunity. The convalescent blood was taken from otherwise healthy adult donors between the tenth and twentieth day of the disease. Only one of eighty-one patients developed mumps, but eleven were discharged before their possible incubation period was over and the results in these eleven are not known. The remaining sixty-nine showed no signs of the disease.

Bonar, Salt Lake City.

A Streptothrix Isolated from the Blood in a Case of Acute Rheumatism, with Remarks on the Classification of Ray Fungi. T. Thjøtta and E. Gunderson, J. Bacteriol. **10**:1, 1925.

An organism isolated from the blood of a patient suffering from a severe attack of rheumatism was found to be a true fungus of Group I of Ørskov and given the name of *Cohnistreptothrix*. As no symptoms in the patient indicated a fungus infection, the microbe was not considered as the etiologic agent. After recovery complement-fixation tests with the blood of the patient were negative. The organism was not pathogenic for animals. The authors assume that the organism was present in the respiratory tract of the patient as a saprophyte and entered the circulating blood when the body defenses were lowered by the severe sickness.

Because the streptothrix was similar (morphologically and culturally) to strains that have caused severe disease with fatal results, the authors urge a thorough study of the organism when found as the cause of disease, and an attempt to classify it by distinct biologic characters.

Westlund, Chicago.

SMALLPOX and CHICKENPOX. H. SAHLI, Schweiz. med. Wchnschr. **55**:1 (Jan. 1) 1925.

Sahli finds that all the diagnostic aids in differentiating smallpox from chickenpox in doubtful cases are unreliable. This applies to Paul's test on the rabbit cornea as well as to diagnostic vaccination. The latter may be positive in smallpox and negative in chickenpox. He promulgates a neo-unitarian theory: The virus of chickenpox is a mutation of the smallpox virus, a little farther removed than vaccinia. The difference in virulence is not merely quantitative, but qualitative. He believes that true smallpox may originate exceptionally from chickenpox.

[J. A. M. A.]

PERTUSSIS VACCINATION. ADOLPH H. MEYER, MARTIN CHRISTENSEN and EINAR SØRENSEN, Ugesk. f. Læger **9**:217, 1925.

This paper presents a study of about 2,100 cases of pertussis treated by vaccine prepared from the Bordet-Gengou's bacillus. A general summary gives the following impressions: (1) from 17 to 23 per cent. may escape the disease if vaccinated; (2) if vaccination is done in the incubation period, the course of the disease is mild; (3) if vaccination is done during the first week of the disease, beneficial results may be noted.

Of interest is the complement-fixation reaction in six children who had not had pertussis. Three of these were given 3 successive injections of vaccine, and it was found that the complement-fixation reaction was at its height eight days after the last injection and disappeared, in one instance, in a month. The three not vaccinated gave, as usual, no complement-fixation reaction. In cases of pertussis the complement-fixation reaction occurs during the third week of the disease. It appears from these findings that there is a short period after vaccination during which there is a maximum resistance to the disease, and this is actually supported by the clinical observations.

SCHLUTZ, Minneapolis.

Chronic Infections

ULTRAVIOLET RAY THERAPY IN PERITONEAL AND GLANDULAR TUBERCULOSIS IN CHILDREN. HENRY J. GERSTENBERGER and SPENCER A. WAHL, J. A. M. A. **83**:1631 (Nov. 22) 1924.

Gerstenberger and Wahl report their observations on the ultraviolet ray treatment of ten children with various forms of tuberculosis. The sole use of ultraviolet rays, as produced by the quartz mercury vapor arc lamp, in their experience has been of decided value in the treatment of peritoneal, glandular and osseus tuberculosis. The results obtained in these types far surpass in regularity, speed and degree, the improvement obtained by rest in bed, laparotomy or soap inunction. Of the glandular forms of tuberculosis, the mesenteric is the most rapidly improved; next the mediastinal, and last the peripheral. No results were obtained in pulmonary tuberculosis of the miliary type, even though the treatments were begun early in the course of the disease.

SPOROTRICHOSIS. W. H. GUY and F. M. JACOBS, J. A. M. A. **83**:1663 (Nov. 22) 1924.

Three cases of this disease in one family are reported in children aged 4, 6 and 8 years, respectively, and one possible case in an adult. Prior to

this, only three human cases have been reported from Pennsylvania although sporadic cases in animals are rather frequent. Case 1 demonstrates the possibility of widespread dissemination of the infection and indicates the possibility of bone liquefying abscesses simulating tuberculosis. Cases 2 and 3 are unique in that they are examples of a human source of inoculation.

PREVENTION OF CONGENITAL SYPHILIS BY TREATING THE MOTHER DURING PREGNANCY. JOSEPH S. LAWRENCE, J. A. M. A. **84**:432 (Feb. 7) 1925.

Some data on the results obtained by treating women during the childbearing period, recently collected from eighteen municipal clinics, are offered as evidence of the great benefits to be derived from careful treatment of ambulant patients at public clinics or dispensaries. The experiences of these clinics lead one to presume that any community has it within its power to reduce materially the number of infant deaths and to increase its birth rate by maintaining such clinics.

PRIMARY TUBERCULOSIS OF THE MUSCLE STRIAE. A. MERLINI, Arch. de méd. d. enf. **27**:641 (Nov.) 1924.

By this term, which is entirely clinical, is meant that rare form of muscular tuberculosis in which the lesions are found in the muscles, without pre-existing lesions of adjacent structures. Histologic and bacteriologic studies are necessary to make the diagnosis absolute. One case is reported in which the diagnosis is fully established by histologic and bacteriologic researches. The rarity of this form of tuberculosis has been considered due to the bactericidal action of the lactic acid formed in the muscles, to an antitoxin secreted by the muscles or to the vascularity and incessant activity of the muscles. Single trauma probably is of little importance in the causation, while repeated light injuries are of more importance. The muscles of the trunk and extremities are most often involved, while the muscles of the tongue and heart are not involved. The lesions may be single or multiple and pathologically consist of firm, nodular enlargements, which on cut section are a grayish pink, with a yellow center if caseation is present. The perifascicular and perifibrillary tissues are primarily involved with secondary fragmentation of the muscles, formation of granulation tissue, with here and there attempts at regeneration. The symptoms are vague, consisting of mild localized pains, more marked in the evening and disappearing at night. Sometimes there are disturbances of function of a muscle or a muscle group, and if the inferior extremities are involved there is nearly always a limp. Objectively, when the muscle is relaxed, a hard nodule of variable size is felt. During contraction, the nodule cannot be palpated. Fluctuation may be felt in the superficial lesions. The condition should easily be differentiated from lipomas, angiomas and fibrous myositis. False or true muscle hernias, and osteomas of the muscles and gummas may afford more difficulty. The prognosis is good when the general condition of the patient is not serious. Treatment is entirely surgical.

PROTEIN THERAPY IN INFANTILE TUBERCULOSIS. F.-K. CIESZYNSKI, Arch. de méd. d. enf. **27**:662 (Nov.) 1924.

Intramuscular injections of horse serum in seven children with pulmonary or intestinal tuberculosis caused painful local reactions and general serum reactions so frequently that the authors advise the abandonment of such injections. The results of the intramuscular injection of sterilized milk, however,

were such that they are encouraged to continue its use in patients in which the disease is not too far advanced.

DIFFUSE POLIOMYELITIS WITH AMYOTROPHIA OF HEREDITARY SYPHILITIC ORIGIN. P. HAUSHALTER, Arch. de méd. d. enf. **27**:740 (Dec.) 1924.

In this case of quadriplegic amyotrophia in a child, aged 7 years, the symptoms came on suddenly, reaching their peak in two days. There were no acute febrile manifestations, pain, or any other disturbances. The Wassermann reaction was twice negative, although the family history was suggestive of syphilis. Later, the child developed signs of a diffuse syphilitic osteoperiostitis of the left tibia. With the institution of antisyphilitic treatment, improvement began, resulting in a complete cure without sequelae. The author believes this sufficient proof to conclude that the poliomyelitis was of syphilitic origin and that in cases of acute or subacute poliomyelitis of doubtful origin, one should not lose sight of the possibility of specific etiology.

PNEUMOTHORAX IN A CHILD WITH TUBERCULOUS CAVITIES. GEORGES SCHRIEBER BIGART and BONNET, Arch. de méd. d. enf. **28**:40 (Jan.) 1925.

In a child, aged 8½ years, with marked ulcerative tuberculosis of the right lung, pneumothorax treatment was performed. Although the treatment had to be prematurely stopped because of the production of adhesions, the child gradually improved and after three years the local and general condition of the patient had greatly improved. This observation is thought to show that this treatment is able, in the child as in the adult, to render unhoped for service that no other procedure is able to furnish.

BONAR, Salt Lake City.

CUBITUS VALGUS, A STIGMA OF HEREDOSYPHILIS. P. L. BALIÑA, Rev. dermat. Argentina **10**:45, 1923.

Report of a case of this bone deformity in a man aged 41, with numerous stigmas of hereditary syphilis. The author calls attention to the frequency of cubitus valgus in cases of hereditary syphilis.

PARDO-CASTELLO, Havana.

TEETH IN CONGENITAL SYPHILIS. E. LANGER and M. WASSMUND, Klin. Wchnschr. **4**:110 (Jan. 15) 1925.

Langer and Wassmund conclude from their observations that the cause of Hutchinson's teeth is in a syphilic affection of the intermaxillary bone and the junction of the jaws. This accounts best for their localization near the middle line.

[J. A. M. A.]

CHANGES IN THE FIRST MOLAR CHARACTERISTIC OF CONGENITAL SYPHILIS. H. PFLUEGER, München. med. Wchnschr. **71**:605, 1924.

Pflueger describes changes characteristic of congenital syphilis, which may occur in the first molars. These changes are not seen often and may be found with or without the typical changes of the upper incisors. One or more of the molars may be affected. The base is of normal width, but the crown

becomes narrower toward the biting end so that the insufficiently developed cusps stand close together. The average diameter of the first molars of a number of normal girls, aged from 12 to 19 years, taken at the base of the cusps, was 13.4 mm., while that of molars of a number of girls with syphilis, in the same age group, was 8.3 mm. The author calls this "Knospenform," that is, bud formation. It leads in some cases to the correct diagnosis. Forty years ago these molars were apparently described by Moon as "reduced in size and dome-shaped through the dwarfing of the central tubercle of each cusp," but this description was forgotten.

HAMBURGER'S PERCUTANEOUS TUBERCULIN TEST. A. WALLGREN, München. med. Wchnschr. **71**:1017, 1924.

Pirquet's cutaneous test is compared with the Hamburger percutaneous tuberculin test. In inactive cases the Hamburger test was positive in 81.5 per cent., the Pirquet test in 62 per cent.; in active cases the Hamburger test was positive in 84.2 per cent., the Pirquet test in 84.7 per cent. In 187 cases both were positive and in 25 both were negative. Eleven times the Hamburger test was positive and the Pirquet negative, while in twelve cases the reverse was true. For the Hamburger test no instrument is necessary and the reaction lasts longer.

THE TREATMENT OF TUBERCULOSIS IN CHILDREN. HANS KARFUNKEL, München. med. Wchnschr. **71**:1166, 1924.

During a period of twelve years, the authors used a vaccine prepared from a perfectly avirulent root bacillus, not related to the tubercle bacillus, in the treatment of tuberculous manifestations of childhood. The main field for the treatment is formed by patients giving a positive Pirquet reaction without open manifestations. A number of patients became negative to the Pirquet test. The paper does not contain any data about this vaccine further than that it is prepared by a chemical factory in Stettin.

TUBERCULIN BY MOUTH. M. KLOTZ, München. med. Wchnschr. **71**:1347, 1924.

Some kinds of tuberculin given per os have a definite influence on the protein concentration of the blood serum, determined refractometrically.

SYPHILIS IN THE THIRD GENERATION. H. CZICKELI, München. med. Wchnschr. **71**:1541, 1924.

The grandmother of an infant, aged 3 months, suffering with congenital syphilis had had several miscarriages and had lost four of seven full term children before seven months of age. Her one Wassermann reaction was negative. The sister of the infant's mother, aged 16 years, had a strongly positive Wassermann reaction, without having been infected. The father's Wassermann was repeatedly negative. The grandfather had undergone treatment. It is concluded that the congenital syphilis of the infant constituted a transfer to the third generation.

THE ADMINISTRATION OF TUBERCULIN BY MOUTH. HERMANN CZICKELI, München. med. Wchnschr. **71**:1724, 1924.

In eleven of twelve children, the administration of old tuberculin by mouth in doses over 1,000 mg. did not produce any observable changes in temperature, pulse, respiration or body weight.

AMBERG, Rochester, Minn.

Internal Diseases

CERTAIN ASPECTS OF ENURESIS. SAMUEL AMBERG, J. A. M. A. **83**:1300 (Oct. 25) 1924.

Amberg tested the mechanism of micturition twenty-five times in eleven boys and seven girls between 5 and 15 years of age, who were suffering from enuresis. The method used by Weitz in a study of normal persons was selected. This consists of filling the bladder with boric acid by means of a catheter to which is attached a manometer. At rest, a certain pressure is registered. Changes in the pressure occur following contractions of the bladder. The children were instructed to register the desire for urinations by means of an electric key. The desire to urinate simultaneously with the contractions was absent twice, and in one of these children the contractions were low. In another, only one contraction preceded the desire to urinate. In all of the rest, desire to urinate was associated with contractions. In other children the desire was lacking at first but later on contractions were accompanied by sensations. The absence of the desire for urination does not seem to be so common as might be expected from the observations of Weitz and Götz. When absent, it can return irrespective of improvement of the enuresis. In some cases the desire for urination coincided rather closely with the beginning of bladder contraction, in others there was a definite latent period of a few seconds between the desire and the onset of contractions, while in others the desire was registered well after the onset of contraction. It appears questionable whether desire occurs without any change in pressure. The results obtained are undoubtedly affected by variations in the intensity of desire or to an uncertainty of sensation and the results must be interpreted with caution. The observation that in several instances there was a drop in pressure coincident with the desire for urination cannot be explained by any of the theories of micturition. The author is of the opinion that too much stress has been laid on the value of suggestive treatment.

COMPLETE TRANSPOSITION OF THE VISCERA. LEON THEODORE LE WALD, J. A. M. A. **84**:261 (Jan. 24) 1925.

Complete transposition of the thoracic and abdominal viscera is more common than one would suppose from an examination of the literature. The fact that the author has personally observed twenty-nine cases can be explained on the basis that the number of individuals studied by the roentgen ray is vastly in excess of those studied in the anatomic or pathologic laboratories or in the operating room. The series comprised twenty-one males and eight females, ranging in age from 4 months to 65 years. Transposition does not impair the health of the individual. Rotation of the heart on an axis, a rare condition, sometimes described as dextrocardia unassociated with transposition of the viscera, is entirely separate from transposition. Retraction or displacement of the heart can always be distinguished roentgenologically from transposition or rotation of the heart. Nonrotation of the colon should never be confused with transposition, from which it can be distinguished by a roentgen-ray examination. Cecum mobile is due to excessive descent of the cecum and is frequently wrongly diagnosed as chronic appendicitis. A combination of two or more of these conditions may be present in the same person.

CONGENITAL ESOPHAGEAL STENOSIS ABOVE CARDIAC ORIFICE. ALFRED A. STRAUSS and JULIUS H. HESS, J. A. M. A. **84**:501 (Feb. 14) 1925.

Esophageal stenosis in the lower end of the esophagus is extremely rare and is usually accompanied by several other congenital anomalies of the gastro-

intestinal tract. The stenosis is never complete. In the narrowed portion, the mucosa is folded longitudinally and the muscularis is several times its normal thickness, while above this the esophagus is dilated to an extent depending on the duration of the constriction. The pathologic picture at operation and the configuration of the roentgenograms were so alike in three cases that they might be taken for one case. Fluoroscopic examination revealed a narrowing of the esophagus just above the diaphragm, and from there upward a marked saccular dilatation. When the sac was filled with barium, marked peristaltic waves and retroperistalsis were seen. The symptoms, which became pronounced at the age when solid food was first given, consisted chiefly of vomiting attacks, and malnutrition. Vomiting may come on at intervals of several weeks, at which times there is inability to swallow any semisolid food and little liquid can be retained. Attacks of bronchitis or bronchopneumonia frequently follow attempts at dilatation of the obstruction. Because of the dangers of esophageal rupture, bronchitis, or bronchopneumonia when dilatation is attempted, the authors advocate a direct operation on the esophagus. The operation is described.

BONAR, Salt Lake City.

HYPERPLASIA OF THE THYROID IN AN INFANT. H. G. GRIEVE, Canad. M. A. J. **15**:187, 1925.

Hyperplasia of the thyroid in infants is comparatively uncommon. The patient was a Canadian girl, aged 15 months, whose mother had a large edema of the thyroid gland. The baby was born at full term and was entirely breast fed for nine months and then given supplementary feedings of whole milk. Between the second and third months a small nodule about the size of a pea developed on the left side of the baby's neck. This increased in size until at the time of entering the hospital it was the size of a golf ball. It caused no discomfort. Operation showed the nodule to be attached to the upper portion of the left lobe of the thyroid. Examination of the mass after removal showed tissue with the characteristics of thyroid hyperplasia.

The interesting points in the case were: (1) Presence of thyroid hyperplasia in an infant, aged 15 months; (2) the absence of any evident clinical signs of hyperthyroidism; (3) the occurrence of a large adenoma in the mother.

MOORE, Omaha.

THE TREATMENT OF PNEUMOCOCCUS EMPYEMA WITH ETHYLHYDROCUPREIN. PIERRE WORINGER, Arch. de méd. d. enf. **27**:713 (Dec.) 1924.

The good results obtained in the treatment of pneumococcic conjunctivitis led the author to use this preparation in other suppurative conditions of pneumococcic origin. Unlike other observers, he was unable to report any cures in four cases of pneumococcic meningitis. Using a method slightly modified from that adapted by Gralka in 1922, he reports full success in the treatment of five cases of pneumococcic empyema. Due to the yellow staphylococcus in two cases, no improvement was noted. The specificity of ethylhydrocuprein was further borne out by the fact that while the pneumococcus disappeared from the cavity in some mixed infections, *B. coli* persisted. The author believes that this is the treatment of choice in pneumococcic empyema in childhood, particularly in the very young since operation gives poor results. As soon as the pleura is sterilized, rapid recovery with complete functional re-establishment of

the lung follows, even in those cases where the pyothorax has existed for a long time. To obtain rapid sterilization of the pleura the best method is the following:

Aspirate as much pus as possible. Inject 25 mg. per kilogram of body weight of a 5 per cent. solution of ethylhydrocuprein hydrochlorid, taking care not to exceed a dose of 0.50 gm. Such injections are made for three or four days. If the temperature is normal the injections may be stopped, but if it recurs, injections may be repeated for two or three days.

LATERAL, ENCYSTED, SEROUS PLEURISY IN THE LARGE PLEURAL CAVITY. E. APERT and R. GARCIN, Arch. de méd. d. enf. **28**:30 (Jan.) 1925.

A case of encysted, serous pleurisy of the right side is reported in a child, aged 10½ years, who had been ill for two years. Strontium lactate caused rather rapid absorption of the fluid. The authors have found this drug efficacious in activating the disappearance of edema and serous collections.

BONAR, Salt Lake City.

PATHOLOGY OF MYXEDEMA. M. G. MARINESCO, L'Encéphale **19**:265 (May) 1924.

In this paper is given a detailed study of the nervous system and other organs in a case of myxedematous idiocy due to congenital absence of the thproid gland. The patient was a girl, aged 15 at the time of her death. The family history was negative. The patient was the first child. Her general development was markedly retarded. She did not walk until the seventh year, and speech was only rudimentary.

The child first came under observation when 13 years old. Physically, she showed a relatively large head and small trunk. The anterior fontanel had remained open, the milk teeth persisted, and all the teeth were poorly spaced. The neck was short, and its size seemingly increased by large pseudolipomas in the subclavicular spaces. The tonsils were large. The thyroid was not palpable. The lower half of the thorax was large, and the abdomen was of the "frog belly" type. The limbs were short, cold and cyanotic. The skin and subcutaneous tissues were thickened. There was no pubic hair. The roentgen-ray showed delayed ossification. The rectal and axillary temperatures were subnormal. There was slight anemia, and differential white cell count revealed 64 per cent. polymorphonuclear cells, 24 per cent. large lymphocytes, 9.5 per cent. small lymphocytes, 2 per cent. eosinophils and 0.5 per cent. basophils.

Mentally, the child was an idiot. She had no spontaneous speech, did not know the names of her parents, and used the term "father" for all men. She could count only to 4. She was distractible and easily irritated or made cry. Her gait was slow and hesitant.

A piece of thyroid gland obtained from a patient of the same age was grafted into the abdominal wall. A few days later, the child seemed brighter; she retained names better, and had a larger vocabulary. Movements were more active, appetite was better, and temperature was nearly normal. The graft atrophied after about six weeks, and the temporary improvement disappeared. There were no changes in the bones visible to roentgen-ray examination as a consequence of the graft.

After various illnesses, the child died, two years later, with a generalized tuberculosis. Postmortem examination revealed a generalized miliary tuberculosis. The lungs showed the presence of bronchopneumonia, and the bronchial lymph nodes were enlarged. The subclavian artery was malformed. There was atrophy of the suprarenal cortex, and the ovaries and the uterus were infantile. There was delayed union of cartilages. The nervous system showed a tuberculous meningitis, and there were miliary nodules in the cortex and corpus striatum.

A microscopic study of the entire nervous system, using various stains, was made. Control sections of the normal brain of a child the same age were used. Allowance was made for the tuberculosis present in the case of myxedema, and sections were taken chiefly from areas not affected by tuberculosis. A comparative study of the various areas of the cortex and their cellular structure was emphasized.

In general, cellular development of all the cortical layers was retarded, yet the cells of the archipallium were not much different from the normal. The cells of all layers of the cortex were diminished in volume—the granular layer suffering the least. In the basal nuclei, there was a decreased volume of the cells but no evidence of changes of cell structure or of fibers. In the corpus striatum, there was an infiltration of vessels in the globus pallidus, with a characteristic iron stain in the muscular portion of the vessel walls. In some areas, the vessel walls showed granules stained by thionin and hematoxylin. The same stains showed such granules in small vessels and in capillaries which were at times obliterated by the deposits. These deposits or concretions were definitely not of calcium. In the substantia nigra, especially in the reticular substance, there were similar deposits.

Marked changes had occurred in the cerebellum. The Purkinje cells were small, elongated and not in their usual position with respect to the cell layers. Their dendrites were decreased in number. In general, the cerebellar cortex was reduced in richness of cells and fibers. In the white substance of the cerebellum, the capillary walls were infiltrated with granules staining with Prussian blue. They were particularly prominent in the dentate nucleus.

Cells of the hypoglossal nerve root and of the anterior horns of the spinal cord were decreased in size. Sections of the spinal ganglions showed the presence of glycogen granules both in the cell cytoplasm and in the axons. These granules occurred throughout the gray substance of the cord, and in the white substance, they were deposited especially in the vessel walls. The dorsal root of the vagus and the olive contained no granulations. In the cortex, the superficial tangential fibers were arrested in development, and other association fibers were decreased in number.

Outside of the nervous system all the tissues showed a reduced volume of parenchyma, but some had large vesicular nuclei containing globules and were decreased in chromatin content.

Summarizing the pathology of the central nervous system, the author states that the cortex and basal ganglions were particularly involved. The persistence of Cajal cells in the hippocampus and other areas, and the reduction of volume of the subgranular layer of cells are evidence of arrested development.

The subnormal temperature has an effect in reducing all metabolic activities, and it is possible that the presence of glycogen granules in the various portions of the nervous system is due to an incomplete and sluggish oxygenation.

HYSLOP, New York.

CHROMOCHOLOSCOPY AS A LIVER FUNCTION TEST IN EARLY CHILDHOOD. OTTO BOSSERT and HERMANN LOERS, Jahrb. f. Kinderh. **107**:291, 1924.

The method used was to insert a duodenal tube in infants, aged from 3 weeks to 1 year, and after the appearance of bile, to inject subcutaneously 5 c.c. of a 2 per cent. methylene blue solution or an equal amount of a 2 per cent. indigo carmin solution in physiologic sodium chlorid solution. Bile was then aspirated at five minute intervals and the time of the first appearance of the dye noted. The indigo carmin colored the bile a distinct green, while the methylene blue usually required heating with acetic acid to bring out its color, since it was decolorized in its passage through the liver.

In cases of bile duct obstruction no pigment appeared in the duodenum, showing that the pigment must pass through the liver. Indigo carmin results

in a slowing of the bile secretion in the injured liver while methylene blue hastens the secretion. The latter is a more sensitive test.

In normal children, methylene blue appears in the bile in from forty to sixty minutes; indigo carmin in from twenty to thirty minutes. Methylene blue appears the quickest and indigo carmin the slowest in children with severe tuberculosis or severe syphilis associated with anatomic changes in the liver. Similar results were obtained with acute nutritional disturbances, and some of the chronic disturbances, especially Mehlnährschaden.

Children with a Jacksch-Hayem anemia did not show sufficient variation from normal to draw definite conclusions regarding injury to liver cells. Two infants with icterus neonatorum and one with icterus from coli sepsis showed a more rapid excretion of methylene blue, while one infant with icterus neonatorum gave a reaction to indigo carmin like that of a normal infant.

ETIOLOGY OF ENDEMIC CRETINISM AND GOITER. B. EBBELL, Jahrb. f. Kinderh. **107**:354, 1925.

The author considers these conditions are caused by the drinking water, and denies that chemical examination has shown an excess of lime or deficiency of iodin in the goitrous regions. The writer suggests that radium or radioactive substances in minute amounts form the toxic substance.

Radium salts are found in rocky regions such as the Alps, the Himalayas and the Andes, and not on the plains. Radium salts may produce effects in the body similar to goiter, remembering the stimulating effect of small doses and the destructive effect of large doses. In minute doses radium salts produce leukopenia, anemia and delayed clotting of the blood. Cretins have a low hemoglobin and low red and white counts. Radioactive substances injure the sex cells, and in cretinism the sex glands are small, atrophic and undeveloped. The roentgen ray causes injury to epiphyses of young persons, and shorter stature. The decreased length of the long bones in cretins is well known.

This is an interesting hypothesis, but only generalizations are presented in this paper.

RETENTIO TESTICULI IN INFANTS AND CHILDREN. ADOLPH VOLLBRANDT, Jahrb. f. Kinderh. **107**:367, 1925.

A truss of gum is used to hold an incompletely descended testicle down in the scrotum by means of constant pressure.

SUTHERLAND, Chicago.

PRIMARY DILATATION OF THE HEART IN EARLY CHILDHOOD. K. BLUHDORN, Monatschr. f. Kinderh. **29**:193, 1924.

The writer reports three cases of primary cardiac dilatation, the symptoms appearing when the child was learning either to walk or to stand, namely, at a time when the heart was meeting increased demands. Necropsy on one patient showed a state of lymphatism with a marked lymphocytic infiltration in the greatly dilated and hypertrophied heart. The other two children recovered.

As the child who died suffered from severe eczema, the infiltration of the heart muscle might have been the result of this process rather than of the status lymphaticus.

The two children who recovered from the acute attack were treated with relatively large doses of strophanthin.

GERSTLEY, Chicago.

LOCAL DRY PLEURISY IN THE SECOND STAGE OF TUBERCULOSIS. GEORG FISCHER, München. med. Wchnschr. **71**:1468, 1924.

In children between 5 and 10 years of age, sensitive to tuberculin, dry pleurisy is frequent. This occurs on the right side at the base, about in the region of the mammillary line and on the left base in the region of the posterior axillary line. It appears more frequently on the right side.

CONGENITAL THYMIC CONSTITUTION. H. SCHRIDDE, München. med. Wchnschr. **71**:1527, 1924.

The average weight of the thymus in the new-born is given for the male as 13.3 gm. and for the female as 12 gm. It may vary between wide limits such as from 7 to 28 gm., the heavier glands occurring more frequently in the male. It is emphasized that a heavy thymus alone is not sufficient for the diagnosis of thymolymphatic constitutions. It is necessary that the medulla be hyperplastic. In addition in such cases, the lymph nodules of the spleen are easily distinguished by the naked eye and the lymphatic tissue of the intestines is hyperplastic.

THE THYMIC CONSTITUTION. H. SCHRIDDE, München. med. Wchnschr. **71**:1674, 1924.

The author had the opportunity to study ninety-seven deaths due to injury, all in working men. Of these, fifty-six belonged to the group of individuals with thymic constitution. Of this group thirty-six were killed by an electric current of 220 volts, that is, persons with thymic constitution succumb more readily to injuries than others. A large thymus alone is not sufficient for the diagnosis, it is necessary to find a hyperplasia of the medulla and hyperplasia of lymphatic tissue elsewhere. The main changes found in such persons are given briefly. It is pointed out that the number of new-born infants with enlarged thymus is greater than their number later on. The thymic constitution is accepted as a congenital constitutional anomaly.

THE TREATMENT OF GOITER IN INFANTS. FRANZ HAMBURGER, München. med. Wchnschr. **71**:1815, 1924.

A new-born infant with a large goiter received 0.001 gm. of sodium iodid once daily for eight days. On the eighth day the goiter had disappeared and the medication was stopped. The child was on the breast, but the weight dropped and the stools became slimy. Three days later death occurred and was attributed to the medication. Another infant, aged 8 months, had a large goiter making a retropharyngeal tumefaction. Under medication with sodium iodid, a total of 0.3 mg., and a thyroid preparation, a total of 15 mg., the goiter disappeared in a week.

AMBERG, Rochester, Minn.

DEATH BY SUFFOCATION AND STATUS HYPOPLASTICUS (STATUS THYMOLYMPHATICUS). MEYER, Ztschr. f. Hals-, Nasen-u. Ohrenh. **10**:262 (Nov. 8) 1924.

The author admits the existence of status thymolymphaticus as a clinical entity, but claims that in many cases it is merely a part of what pathologic anatomists recognize as hypoplasia of the chromaffin system, principally indicated by very small suprarenals. He also mentions a congenital, isolated thymus hyperplasia, and a condition of status lymphaticus acquired through

infection. He also distinguishes thymic asthma, thymic death and laryngismus stridulus.

In status hypoplasticus, sudden death may occur with or without suffocation symptoms, and the question is raised, are these deaths due to mechanical or to secretory causes? The author believes that most of them are due to constitutionally inferior internal secretory organs. He reports a necropsy on a child, whose suffocative symptoms had been temporarily relieved by tracheotomy. Examination showed evidence of rickets, enlarged thymus, enlarged lymphatic glands throughout, including follicles at the base of tongue, Peyers patches, intestinal follicles, etc., both suprarenals exceedingly small; pharyngitis, bronchitis, tracheitis. There was no evidence whatever of compression of the trachea, bronchi, the large vessels or the vagi, and the author is certain that the position of the tracheal cannula during life was correct and that there was no obstruction from that source.

The author suggests the use of epinephrin to avert death in such cases. (Epinephrin is made from the corex, while the medulla is essential to life. A. L.)

LEWY, Chicago.

AN INVESTIGATION OF KIDNEY FUNCTION BY A FOUR-HOUR WATER TEST. A. NORGAARD, Ugesk. f. Læger. **8**:165, 1925.

This test is carried out as follows: The patient remains in bed, and no food or water is taken in the morning before the test. The bladder is completely emptied at 6:30 a. m., and the specific gravity of the specimen noted. Between 6:30 and 7:00 a. m. the patient takes 1 liter of water. The specific gravity and the amount of urine voided are measured and tabulated for each hour until 11:00 a. m.

In a series of 185 patients with various diseases, it was found that the ability to concentrate and to excrete water was markedly decreased in cases of arteriosclerosis of the kidney, nephrosis, chronic glomerular nephritis and tuberculosis of the kidney.

From the data thus obtained the author determines the index of kidney function. This index is the product of the amount of water excreted in cubic centimeters, and the maximum variation in specific gravity of the lowest hourly specimen from the 6:30 a. m. specimen.

SCHLUTZ, Minneapolis.

Nervous Diseases

SOME OF THE BEHAVIOR ABNORMALITIES OF CHILDREN: THEIR GENESIS AND THEIR MANAGEMENT. LANGLEY PORTER, Arch. Pediat. **42**:1, 1925.

It is illuminating that behavior neuroses occur for the most part in solitary children, solitary sometimes because they are the youngest or the oldest of a family, with a long interval between them and the nearest brother or sister, or even they may be solitary from a confining or a chronic illness which keeps them apart, and sometimes they are solitary because of the resistance of parents or grandparents to the natural growth of the child's independence. Elders of this type use every pretext to keep the child dependent. Every trivial hurt or sickness is exaggerated until the child is intolerably hypochondriacal. The important fact for the physician is to recognize that on the one hand such neuroses may complicate severe physical disorders, and on the other that grave disabilities, such as vomiting, anorexia, diarrhea and anemia may be sequels

when the neuroses are primary. As a logical sequence, it follows that in either instance proper treatment demands a careful study of the physical as well as the psychic changes concerned. Neuroses must never be accepted as an adequate diagnosis until the possibilities of pathologic change have been excluded, and in the end no appropriate therapeutic measures can be neglected without injustice to the patient.

VON MEYSENBUG, New Orleans.

TREATMENT OF ARSPHENAMIN "ENCEPHALITIS" WITH SODIUM THIOSULPHATE. R. H. MCBRIDE, J. A. M. A. **84**:729 (March 7) 1925.

A child, aged 4 years, complained of headache and nausea three days after the third intravenous injection of sulpharsphenamin. Drowsiness was followed by convulsions and deep coma. The condition was diagnosed "hemorrhagic encephalitis," the result of arsphenamin administration. Prompt and complete recovery followed the intravenous administration of sodium thiosulphate.

POSTDIPHTHERITIC PARALYSIS OF THE DIAPHRAGM. L. A. ALESEN, J. A. M. A. **84**:730 (March 7) 1925.

Postdiphtheritic paralysis of the diaphragm is so universally fatal that the report of a patient who recovered is of interest. The clinical symptoms and roentgen-ray findings in this case show it to be an undoubted instance of bilateral postdiphtheritic paralysis.

BONAR, Salt Lake City.

SOME EXPERIENCES WITH MENINGITIS AND DESCRIPTION OF A NEW SIGN. T. WISTER WHITE, J. Missouri State M. A. **22**:59, 1925.

The author states that, in 1911, he reported the results of experiments in tapping the lateral ventricles through the anterior fontanel in infant cadavers and advocated the treating of meningitis in infants with open fontanels by that route, in the hope of lessening the tendency to develop obstruction.

The author also refers to the intravenous and intraspinal injection of gentian violet in pneumococcus infection. His patients had been sick so long that the results, so far as cures are concerned, are unsatisfactory.

A new sign in meningitis is emphasized, namely, rigidity of the dorsal and lumbar spine. This was observed by the author while he was a medical officer at Camp Mills.

The patient maintains a "very erect soldierly carriage."

This posture, he believes, exists in meningitis and other conditions with increased intraspinal pressure.

SCHORER, Kansas City, Mo.

THE MENTAL SEQUELAE OF EPIDEMIC ENCEPHALITIS IN CHILDREN. ARTHUR J. HALL, Brit. M. J. **1**:110-111, 1925.

Epidemic encephalitis, although often affecting children, is not predominantly a disease of childhood. About 40 per cent. of the 500 cases, observed by the author in Sheffield in 1924, occurred in persons under 16 years of age. The virus of encephalitis appears to have a particular predilection for attacking the upper and upper middle nervous centers, the functional development of which begins some time after birth and is not complete till well on in adult life.

Ten years ago, the clinical pictures that are now observed in childhood with encephalitis were unrecorded, or at least thought to occur only in adult or senile years. Paralysis agitans under 40 years was extremely rare while hooliganism, homicide and suicide in children of tender years are certainly events for which the community is unprepared and unaccustomed.

This posture, he believes, exists in meningitis and in other conditions with familiar to all, and he divides the chronic condition into the following classes:

1. Idiotic group.
2. Parkinsonian group.
3. Apache group.
4. "Difficult child" group.

The first group comprises mostly those under 5 years, and are characterized by prolonged sleep and nocturnal restlessness; the damage he considers irreparable and offers no suggestions for management.

In the second group, which comprises those over 10 years, he finds it most difficult to estimate the amount of mental defect on account of the coexisting motor disabilities.

In the Apache group the child is completely changed in character. He is aggressive, cheeky and untruthful. He quarrels, fights, wanders, is dirty in his habits and exhibits sexual tendencies and may even be homicidal or suicidal.

The last group is difficult of classification, especially so, as many can be classed in the third or Apache type group. They are difficult children to manage, mental effort tires them, they cannot concentrate, their emotions may be dulled or obliterated and in many the habit of sleep at night has been lost. The loss of emotional affectivity deprives the parent of the chief means of guidance and control.

Regarding therapy the writer finds it difficult. Two points, however, stand out preeminently: (*a*) protection of the community against the Apache and how to restore him; (*b*) to prevent the difficult child from developing into an Apache or wastrel. Institutional treatment through example may be helpful for the difficult child and certainly essential for the protection of the public in the case of the Apache type. This may be expensive and a difficult ideal to carry out, but the numbers in any locality would not be large, for it seems as great a thing to save a damaged mind as to save a damaged limb.

BROWN, Toronto.

THE VALUE OF CHLORID DETERMINATIONS OF THE CEREBROSPINAL FLUID IN THE DIAGNOSIS OF MENINGITIS. H. NOWICKA, Arch. de méd. d. enf. **27**:726 (Dec.) 1924.

It is concluded that one cannot attribute the same value to these determinations that Mestrezat gave to them in 1911. The decrease of the chlorids, characteristic of tuberculous meningitis, is not absolutely constant. Exceptions are seen in the initial period when the diagnosis offers the most difficulty. The diagnosis should not be made from an isolated analysis of the chlorid content of the cerebrospinal fluid. The determinations, nevertheless, are of value when associated with bacteriologic and cytologic examinations and should merit more attention than has been given them up to the present time. They found values of from 0.59 to 0.63 per cent. sodium chlorid characteristic for tuberculous meningitis, the lower value being pathognomonic. Values of from 0.64 to 0.69 per cent. sodium chlorid generally were found to be characteristic

of acute purulent meningitis, but sometimes such values were obtained in the early stages of tuberculous meningitis.

BONAR, Salt Lake City.

PATHOGENESIS OF DIFFERENT FORMS OF TETANY. OTTO TEZNER, Monatschr. f. Kinderh. **29**:207, 1924.

In the same person, calcium lactate is almost as speedily effective as ammonium chlorid in relieving symptoms of tetany. Thus, calcium must have a specific action of its own, and not act only through the acid radicle in the salt usually used, namely, calcium chlorid. In practice, ammonium chlorid is to be preferred, owing to its quicker effect.

There is no difference between the hydrogen ion concentration and the total urinary acidity of well children and those with spasmophilia.

In a hyperventilation experiment on a patient, the author was able to produce symptoms of spasmophilia and at the same time reduce the acidity of the blood. But injection of 4 per cent. sodium bicarbonate solution while reducing the acidity of the blood did not produce any of the other symptoms.

Tezner concludes from the foregoing observations that there are other factors besides alkalosis in the production of spasmophilia.

GERSTLEY, Chicago.

PYOCYANEUS MENINGITIS. KLIEWE and KOCH, München. med. Wchnschr. **71**:867, 1924.

The cerebrospinal fluid of a boy, aged 3½ years, with relatively mild meningitic symptoms showed the presence of *Bacillus pyocyaneus*. After about four months he had recovered completely.

THE SINUS REFLEX OF THE SINUS CAROTICUS BROUGHT ABOUT BY A BRANCH OF THE GLOSSOPHARYNGEAL NERVE. H. E. HERING, München. med. Wchnschr. **71**:1265, 1924.

Previously the author demonstrated that the Czermak reflex (slowing of the heart beat by pressure on the neck) is not due to pressure on the vagus but is a reflex originating in the sinus caroticus, situated at the root of the carotis interna. In addition, another vasodilator reflex originates here which lowers the blood pressure. It could be shown that cutting of a branch of the glossopharyngeal nerve brings about a rise of blood pressure and the sinus reflexes can no longer be obtained by stimulating the sinus caroticus but can be obtained by electrical stimulation of the central end of the cut nerve. This branch of the glossopharyngeal nerve is called sinus nerve.

AMBERG, Rochester, Minn.

THE RÔLE OF OXYDIZING FERMENTS IN THE VITAL PHENOMENA OF THE NEURON. G. MARINESCO, Schweiz. Arch. f. Neurol. u. Psychiat. **15**:3, 1924.

In carrying out this work, the newer methods of ultramicroscopy, vital staining and histochemistry have been used. In all nervous centers, oxydizing ferments exist only in the cytoplasm, in the dentrites and in the cone of origin of the axon. The granules may be found in the fine nerve terminals of the sensory endings and in the corpuscles of Meissner and Krause, of Pacini, Golgi, etc. They are also noted in the sympathetic ganglions, which are devoid of a myelin sheath. Immediately on the appearance of the myelin sheath, the oxydizing ferments disappear. This general rule, however, has some exceptions.

The cerebral cortex offers a rather interesting topography with regard to these ferments. The neuroglia cells of the first layer do not contain them, but they are found in the nerve cells of the other layers of the cortex. In some of the larger cells, it is found that when pigment appears, the oxydases disappear. The older the animal, the greater the amount of pigment; it is therefore advantageous to study the ganglion cells of younger animals. It is found that in the lumbar ganglions of a young dog or rabbit, the entire cells are filled with oxydasis. It is further seen that there are clear cells and cells which are obscure; in the first, the dispersion of the oxydizing ferments is greater, and in the second, the granules approach each other so closely that it is difficult to distinguish them separately. Near the nodes of Ranvier, a characteristic border is noted, owing to the granular appearance of very fine oxydizing ferments. In the gray matter of the cord, the nerve cells are buried in the background of oxydizing ferments. No doubt these are located in the pericellular plexuses and take part in the formation of the synapses.

In nerve cells in which black pigment occurs, such as those of the locus niger and of the locus coeruleus, it is seen that oxydizing ferments occur in inverse proportion to the pigment. In infants, melanin is not found; however, this increases with age until in the adult the melanin granules almost fill the entire cell. This is also noted in pigmented areas of the skin, for example, in the areola of the breast, where one finds no trace of oxydizing ferments. These greatly pigmented cells seem to be relatively inactive physiologically.

There is a certain relationship between the development of the fuchsinophilic granules and that of the oxydases. In a 7 months fetus one finds an abundance of fuchsinophilic granules in the nerve cells; fuchsinophilic granules seem to be a measure of actively developing cytoplasm.

In the regeneration of nerves, oxydizing ferments appear. The activity seems to be governed by the temperature factor, and a great difference is noted in the regeneration of nerves of poikilothermal and homothermal animals. In the frog, for example, the phenomena of regeneration are functions of the temperature.

The phenomena of neurotropism are probably dependent, at least in part, on the activity of oxydizing ferments.

In pathologic states such as amyotrophic lateral sclerosis, progressive muscular atrophy, the myopathies, etc., the process of degeneration goes hand in hand with a diminution of oxydases.

CONCERNING THE TREATMENT OF EPILEPSY BY MEANS OF THE PASTEUR VACCINE AND THE INJECTION OF STERILIZED MILK. N. D. OSSOKIN and S. M. OCHSENHÄNDLER, Schweiz. Arch. f. Neurol. u. Psychiat. **15**:60, 1924.

Protein therapy in the treatment of epilepsy is nothing new. Darkschewitsch gave subcutaneous injections of brain extract with the idea of increasing the immunity of brain tissue. The treatment of epilepsy by means of rattlesnake poisoning was conducted along similar lines. In 1914, Nikitin treated epilepsy with a Pasteur vaccine and submitted favorable reports. Bondarief and Worobjowa utilized sterilized milk. The authors were led to try this treatment because of the difficulty of obtaining drugs during the war. The vaccine, as a 1 per cent. emulsion of a cord dried three days, was given under the skin of the back. In adults, 0.5 to 1 to 2 c.c. were given daily. The treatment was continued for thirty days. After the interruption of a week or several months, the second course consisting of thirty injections were given. Sometimes a third course followed.

In 25 per cent. of cases, considerable improvement resulted; in 50 per cent., the result was merely satisfactory; in 25 per cent., it was entirely ineffective. This treatment was sometimes combined with the administration of chlorotone, which enhanced the favorable result. It must be added that chlorotone used alone was not followed by such favorable improvement.

Sterilized milk was given in twenty-three cases which were under observation for from five months to one year. Milk from the same cow was filtered, sterilized for twenty minutes, and injected every three to four days. In 17.4 per cent., a good result was obtained; in 43.5 per cent., a relatively good result was noted. On the whole, the Pasteur vaccine was followed by a larger incidence of improvement. Psychic equivalents remained entirely uninfluenced.

CELL AND ALBUMIN CONTENT OF NORMAL SPINAL FLUID. AXEL V. NEEL, Schweiz. Arch. f. Neurol. u. Psychiat. **15**:70-96, 1924.

A survey of the literature shows at once that the results of the study of normal spinal fluid varies considerably according to the country, the type of material available and the methods used. Neel wished to avoid all factors which might result in error. In order to do this, the laboratory worker was kept in ignorance of the case from which the spinal fluid was obtained; punctures were made with patients in different positions; the fluid was divided for different tests, now this way and now that; as a rule, from 4 to 6 cm. were withdrawn; the Fuch-Rosenthal counting chamber was used. His earlier conclusions led him to the belief that 6-3 represented the maximum count obtained under normal conditions.

The albumin test was made with ammonium sulphate and potassium sulphate, according to Ross-Jones-Brandberg-Bisgaard, and the globulin estimation according to Buillain-Nonne-Apelt-Schumm. The Pandy method was used by the author, who endorses it heartily and thinks that when it is negative, a pathologic increase of albumin does not exist.

The analytic study of entirely negative cases showed a cell count of 0 to 1-3, globulin 0, albumin under 10. When the patient gave a history of syphilis, these findings were often increased. The author believes that there is always some reason when the cell count or albumin content exceed the foregoing figures. In about 7 per cent. of cases, there was an increase in cells above 1-3; Neel believes this can be explained by our inability to demonstrate clinically that these cases are absolutely normal. He believes that fully 82 per cent. of syphilitic patients have involvement of the nervous system.

WOLTMAN, Rochester, Minn.

THE OPERATIVE MANAGEMENT OF INFANTILE PARALYSIS (POLIOMYELITIS). PAUL DEUS, Schweiz. med. Wchnschr. **55**:182, 1925.

Deus reviews the various surgical manipulations which have proved of value in recent years in cases of poliomyelitis.

ELTERICH, JR., Pittsburgh.

Diseases of the Eye

CASE OF ORBITAL HEMANGIOMA TREATED WITH RADIUM. A. C. JONES, Northwest Med. **24**:11 (Jan.) 1925.

Jones reports a case of cavernous hemangioma of the orbit, not involving adjacent structures, which was successfully treated with radium. The patient

was 6 years of age. He was first seen in May, 1923. Since then there has been a steady improvement in the vision and recession of the tumor, until now it is impossible to detect any difference of the two eyes and appendages. There is binocular vision. This is said to be the first case of cavernous hemangioma of the orbit treated with radium.

[J. A. M. A.]

Diseases of the Nose and Throat

PATHOLOGIC BASIS FOR ROENTGEN-RAY TREATMENT OF TONSIL DISEASES. W. WARNER WATKINS, J. A. M. A. **83**:1305 (Oct. 25) 1924.

The author believes that the tonsil should be conserved through the adolescent period whenever it is possible. He is of the opinion that irradiation of the tonsil can be applied effectively, accurately and with safety in those instances in which the pathologic changes are of a hyperplastic nature, and where atrophy of the tonsil and reestablishment of drainage is desired. When the tonsil is damaged so that reestablishment of drainage is not to be expected, or where there is evidence of retained pus within the tonsil or internal to it, surgery is indicated if clinical conditions call for radical treatment.

BONAR, Salt Lake City.

Diseases of the Skin

ERYTHREDEMA. JOHN BUTLER, Arch. Derm. & Syph. **11**:166, 1925.

Erythredema has been reported by many writers as acrodynia, pink disease and perhaps pellagra. The name acrodynia has been rather universally applied to the disease under discussion because of its close resemblance to the disease occurring in the French epidemic of 1828. Butler is convinced that erythredema is a disease entity, and should be permanently separated from the cases of acrodynia as occurring in the French epidemic. Dr. H. Swift was the first to call these cases erythredema, and Butler suggests that this name be continued, as it is perhaps as appropriate a term as any other.

Extreme mental irritability, depression and drowsiness are prominent symptoms, and appear early. Photophobia is usually marked. Profuse hyperhidrosis is a marked symptom, and varying paresthesias and anesthesias of the skin are quite constant. The cutaneous eruption is divided into two types; a generalized, itching, miliary rash, and a cyanotic red, swollen, scaling condition of the hands and feet, which is pathognomonic of the disease. The histopathologic picture was characterized by hyperkeratosis and edema of the corium.

The etiology is obscure. The majority of the cases occur in the Spring. The age limits are from 3 months to 7 years. The prognosis is good, about 5 per cent. die, chiefly from pneumonia.

Butler reports a case in detail.

DERMATITIS GANGRENOSA INFANTUM. H. V. DWYER and G. H. KLINKERFUSS, Arch. Derm. & Syph. **11**:368, 1925.

The authors briefly review the literature and report a case of dermatitis gangrenosa infantum occurring in a colored boy, aged 14 months. The case was rather unusual as the patient entered the hospital suffering from the disease of apparently primary origin, associated with pertussis, with broncho-

pneumonia secondary to measles; while in the hospital, the child developed a second series of gangrenous lesions subsequent to varicella contracted from his neighbor in the ward. The lesions showed progressive improvement under local applications of 1 per cent. resorcin in saturated solution of boric acid, followed by a dusting powder of thymol iodid.

The child subsequently died of an apparent pyemia, localizing in the lungs.

PEARSALL, Salt Lake City.

XERODERMA PIGMENTOSUM. A CLINICAL AND PATHOLOGICAL REPORT OF ONE CASE. A. R. RICH, W. C. DAVISON and C. G. GREEN, Bull. Johns Hopkins Hosp. **35:** (Sept.) 1924.

The authors report a typical case of xeroderma pigmentosum occurring in a patient aged 2 years. Brown freckles first appeared over the face. These gradually became pustular and exuded a purulent discharge. They then became encrusted and resembled hard warts. The individual lesions then gradually increased in size, and many of them coalesced. The condition also involved part of the skin of the neck. Eighteen months after the onset, one of these warts developed on the side of the nose, grew rapidly and finally eroded part of that organ. The hands and arms were also involved. The lesions were pruritic.

1. A biopsy was made of what appeared to be normal skin from the buttock. There were certain cellular changes which suggested a beginning atrophy of the epidermis, with a coincident increase in the amount of melanin pigment within the epithelial cells and corium.

2. A biopsy was made from a smooth, shiny, atrophic looking, lightly pigmented piece of skin from the abdomen. Microscopically, it showed an extreme atrophy and disorganization of the epthelium, with pigmentation; but there was no noticeable change in the vascular, connective or elastic tissue elements of the corium.

3. A biopsy section taken from the neck included a small wart-like excrescence and a darkly pigmented portion of otherwise normal appearing skin. Epithelial atrophy, which became extreme, marked pigmentation and beginning proliferation of the epithelium in localized areas to form benign wart-like growths were found.

4. The biopsy specimen from the cheek was a small, slightly elevated bright red area with telangiectasis. The contiguous skin was pale and smooth, and had the appearance of an old scar. This showed, microscopically, a slight epithelial change, but a marked increase in the connective tissue and an almost complete disappearance of elastic fibers of the corium.

5. A biopsy specimen was taken from a small warty excrescence. Microscopically, it showed the development of a wartlike tumor, with slight invasive properties in a portion of the skin.

6. Biopsy of a fungoid warty tumor showed four epithelial tumors of distinctly independent origin, which ranged in size from a very small proliferation of only a few cells, through a large benign wart, to a larger malignant, invasive epithelioma. There were no abnormal deposits of pigment.

7. A small warty nodule was removed from the neck before radium treatment was instituted. This showed a rather invasive epithelioma and a replacement of corium by a fresh growth of connective tissue which appeared to be a true connective tissue tumor.

The authors state that it is usually believed this disease follows a course which may be divided into four stages: first, the stage of inflammation and

reddening of the skin; second, the stage of pigmentation; third, the stage of atrophy, roughening of the skin and telangiectases; and finally, the stage of tumor development. But its progress is not so definite.

Radium exerted no permanent beneficial effect.

The patient died at the age of 4, but no evidence of metastases was found.

McCafferty, New York.

Aniridia in Five Generations. Hugh L. Dwyer, J. A. M. A. **83**:1587 (Nov. 15) 1924.

Tracing the family of a child with hereditary absence of the iris, the author was able to find nine cases and obtain a good family history of fifteen cases in five generations. The character behaves as a mendelian dominant.

A Study of the Clinical Course of Generalized Edema. C. A. Aldrich, J. A. M. A. **84**:481 (Feb. 14) 1925.

The purpose of this study was to: (1) report observations made on the clinical course of generalized edema seen in three cases of a simple type, nephrosis; (2) discuss a possible explanation of these findings; (3) call attention to the fact that the conception that edema may have a function is entirely compatible with its clinical behavior, and (4) point out the influence such reasoning might have on therapy. In six attacks of generalized edema in three cases of nephrosis, there was such a marked similarity of events that a clinical course, as seen in these cases, could be outlined. In brief, generalized edema appeared insidiously, associated with an infectious process, and progressed over a period of many days, during which the body weight increased and the urinary output was scanty. This fluid did not seem free to escape through a needle puncture wound. A point was reached at about the middle of the attack, at which the subcutaneous edema of the upper part of the body began to subside and serous effusions became more marked. During this period, the weight did not drop, and the urinary output remained low and edema of the lower extremities was puncturable. A few days later the urinary output increased, sometimes quite suddenly, the body weight dropped and the serous effusions disappeared, this process usually taking much less time than that required for the increase in weight. It is felt that this behavior can be explained on the hypothesis that toxins elaborated in the infectious process so affect the tissue colloids that their affinity for water is increased (edema); and that this affinity is lost when the intoxication decreases with resulting elimination of fluid. It is suggested that, in nephrosis, edema may have a protective function in diluting the toxins in the tissues. It is possible that fluid restriction, especially combined with dehydrating measures may, interfere with the function and intensify the intoxication.

Bonar, Salt Lake City.

Acrodynia. J. B. Bilderback, J. A. M. A. **84**:495 (Feb. 14) 1925.

Bilderback reports a case occurring in a boy, aged 7½ years. In 1920 this author reported ten other cases and up to the present time he has observed twenty such cases. He states that the name "acrodynia" is unfortunate, as the condition that occurs sporadically in infants and children is in no way the same as the disease called acrodynia which occurred in epidemic form in France. However, he makes no suggestion to change the nomenclature,

although he mentions the terms erythredema and dermatopolyneuritis, as suggested by other authors.

He reviews the symptoms and classifies the photophobia, mental irritability, hyperhidrosis, erythematous eruption on body, and the cyanotic, swollen, desquamating eruption of the hands and feet as characteristic of this disorder. Another rather striking feature seen in the majority of cases is the loss of teeth. Pefectly sound teeth loosen in their sockets and fall out spontaneously. Ulcerative stomatitis may follow, and even necrosis of bone.

The etiology is unknown; treatment is purely symptomatic and unsatisfactory.

PEARSALL, Salt Lake City.

DIABETIC CATARACTS IN AN INFANT. RALPH H. MAJOR and EDWARD J. CURRAN, J. A. M. A. **84**:674 (Feb. 28) 1925.

The authors describe what appears to be the earliest instance of diabetic cataracts. The infant was 11 months old when first seen and was suffering from bilateral cataracts and diabetes.

BONAR, Salt Lake City.

REACTION OF SKIN TO VACCINIA VIRUS. J. C. G. LEDINGHAM, Brit. J. Exper. Path. **5**:332 (Dec.) 1924.

The vaccinal lesion has been studied histologically by Ledingham in its various manifestations following cutaneous, intradermal, subcutaneous, intravenous, intraperitoneal and intrasplenic inoculation, and both naked eye and histologic data have been controlled by inoculations of virus mixed with viricidal serum. The lesion is essentially of the order of an acute infective granuloma in which the reticulo-endothelial system is primarily and dominantly involved. There is no evidence that vaccinal virus possesses an elective affinity for epiblastic tissue. The lesions of vaccinia and of molluscum in the hen are histologically of the same order so far as the dermal response is concerned. Evidence is afforded that precisely similar tissue responses occur when the virus is introduced into tissues remote from epiblast, such as the subcutis, the peritoneum and the spleen. In contradistinction to vaccinia, anti-epidermal serum when introduced intradermally produced an early and definite toxic action on epiblastic elements of skin.

[J. A. M. A.]

A CASE OF DIARRHEA RESULTING FROM A FOREIGN BODY IN THE INTESTINE. ADAN CUADRA, Arch. de méd. d. enf. **27**:676 (Nov.) 1924.

The author reports the occurrence of diarrhea and fever in an infant, aged 3 months, which subsided following the passage of a bird feather.

BONAR, Salt Lake City.

ENDOCRINOUS DISTURBANCES IN ECZEMA. J. L. CARRERAS, Rev. dermat. Argentina **10**:103, 1923.

The author has found symptoms of endocrinous disturbance in 250 of 430 cases of eczema examined. Epinephrin, thyroid and in some cases pluriglandular extracts proved curative.

PARDO-CASTELLO, Havana.

PANCREAS TREATMENT OF ECZEMA AND SEBORRHEA IN INFANTS. RUEDA, Semana med. **2**:1190 (Nov. 20) 1924.

Analysis of such cases seems to show that the assimilation of fat is not quite normal, and Rueda declares that it is logical to seek to reenforce the

pancreas in its task of coping with the fat in the milk by supplying a homologous substance. He has been amazed at the success of feeding pancreas to such infants, and here reports a new series of cases, bringing the total to seventy-five in which seborrheic eczema of the scalp or elsewhere, and certain other forms of eczema, were effectually combated by feeding pancreas tissue in tablet or pulverized form, from 0.5 to 2 or 3 gm. daily. The cure was complete in from one to four weeks. His series includes several cases reported by other physicians in Argentina and elsewhere.

[J. A. M. A.]

Dermatitis Exfoliativa. A. Hotz, Jahrb. f. Kinderh. **107**:259, 1924.

A small epidemic (five cases) of pyodermia is described, which in two of the children developed into typical dermatitis exfoliativa. The epidemic evidently started with a case of impetigo contagiosum in the ward for the new-born. *Staphylococcus albus* was found in the lesions of this patient and of the patient with exfoliative dermatitis. One of these was an infant with exudative diathesis. The response to potassium permanganate therapy was prompt.

Sutherland, Chicago.

A Case of Lesion Due to Roentgen Ray. Kurt Stordeur, München. med. Wchnschr. **71**:617, 1924.

A girl, aged 12 years, had been treated at the age of 2 with roentgen ray for a tuberculous process of the middle finger of the right hand. At the time of examination, the skin of this finger showed an extensive roentgen-ray atrophy with pronounced formation of telangiectasis. The finger was curved, and in the roentgen-ray picture all three phalanges appeared shortened by from 2 to 4 mm. and showed other abnormalities.

Amberg, Rochester, Minn.

Surgery and Orthopedics

Köhler's Disease of the Talsal Scaphoid or os Naviculare Pedis Retardation. F. C. Kidner and Felipe Muro, J. A. M. A. **83**:1650 (Nov. 22) 1924.

Köhler's disease consists of two distinct entities. The authors suggest the term, os naviculare pedis retardatum, for the form occurring in the scaphoid of the tarsus and the names metatarsus planus and os lunatum retardatum for the forms occurring in the head of the second metatarsal or in the carpus. The condition is most commonly found in boys between the ages of 5 and 8 years, and is usually unilateral. Trauma seems to play a part in about one third of the cases but in all probability single trauma has little to do with it. The symptoms consist of pain on walking, tenderness over the scaphoid and swelling. Occasionally redness, heat and dilatation of the superficial veins together with limitation of extreme motions is present. Roentgen-ray examination reveals abnormal density of the bony nucleus of the scaphoid, increase in size of the bone and ragged outline. The condition must be differentiated from simple trauma, foot strain, early tuberculosis, acute or subacute osteomyelitis, syphilis or arthritis. After careful consideration of all the evidence adduced from the literature, from the examination of the patients and from the few pathologic examinations, the authors believe that the disease is an interference with the power of bone production in the scaphoid of the foot

due to a low grade infection, the source of which is unknown. Concerning the treatment, they advocate long continued rest of from two to three months with the foot in strong over correction in varus and cavus. One case is reported.

SURGICAL PATHOLOGY OF THE URINARY TRACT IN INFANTS. HENRY G. BUGBEE and MARTHA WOLLSTEIN, J. A. M. A. **83**:1887 (Dec. 13) 1924.

The study was based on a review of 4,903 necropsies in children. In 117, kidney lesions were present, twenty-four of which were associated with other malformations and eleven with other abnormalities. One case each of single kidney and double ureter were found. Fused kidney was noted three times, rudimentary kidney five times and renal displacement six times. Fifteen cases of polycystic kidney were noted, two of monocystic kidney and three of cystic kidney with hydronephrosis. Horseshoe kidney occurred ten times, nephrolithiasis thirteen times, and pyonephrosis nine times. Of the forty-four cases of hydronephrosis, twenty-five were bilateral and nineteen unilateral. Cardiac malformations were present five times, imperforate anus and inguinal hernia three times each, and spina bifida, esophageal stenosis and pyloric stenosis twice each. Congenital syphilis was present in five, and status thymicolymphaticus in two. The finding of renal calculi in thirteen infants, all but one under 1 year old and one in a child of 11 days, suggests the possibility of calculi formation in the fetus. All of these infants harbored an infection and all but three showed a severe grade of gastro-enteritis. It seems fair to assume that calculi are more common than has been generally supposed, many indefinite colics possibly being due to this cause. The largest series of cases was that of hydronephrosis. Valve formation in the ureter was the most common cause, with hypertrophy of the verumontanum next in frequency. No cause was found in nine cases. Less than one third of the infants lived over six months. This summary of cases should serve to emphasize the necessity for thorough investigation of all infants, regardless of age, that present an indefinite abdominal tumor, obscure abdominal colics, a disturbance of urinary function hematuria or persistent pyuria.

THE HEREDITY OF COMPLETE RECTAL PROLAPSE. REUBEN OTTENBERG and LEO GOTTSCHALK, J. A. M. A. **84**:335 (Jan. 31) 1925.

In the family described, prolapse of the rectum could be traced back through previous generations. It appears to be a mendelian recessive character, showing no limitation to one sex.

FRACTURE OF SKULL IN CHILD. F. P. RICHARDS, J. A. M. A. **84**:749 (March 7) 1925.

A child, aged 4 years, received a crushing injury to the skull in the left parietal region, with extensive injury to the brain. Following operation the child recovered, and during the subsequent three years has failed to show any findings which might be attributed to the extensive brain injury.

BONAR, Salt Lake City.

MUCOUS CYST OF CECUM (CONGENITAL); PRIMARY INTUSSUSCEPTION; GENERAL CONSIDERATION. A. T. BAZIN, Canad. M. A. J. **15**:130 (Feb.) 1925.

Bazin reports the case in a boy, aged 8 months, whose past history showed two previous attacks of partial obstruction which were relieved by laxatives

and enemas. The attack reported began five days before entering the hospital; the symptoms were those of ordinary intussusception. Operation showed the intussusception to be in the ileo-cecal region. After reduction of the intussusception a mass was found in the wall of the cecum just above the ileo-cecal valve; resection was done and the baby made an uneventful recovery. The author gives a detailed report of the tumor, which was a cyst about 3 cm. in diameter, containing dark brown thin fluid. Histologic examination of the tumor showed that the walls had similar structure to that of the intestine.

A review of the literature shows only twelve cases of this condition reported, although undoubtedly many have been diagnosed as irreducible intussusception.

Following the case report, the author gives a summary of the subject of acute and chronic intussusception.

MOORE, Omaha.

THE TRANSMISSIBILITY OF CONGENITAL CLUBFOOT. J. KOCHS, München. med. Wchnschr. **71**:1196, 1924.

The author refers to the genealogical chart of a family, in which four generations furnished eleven individuals with congenital clubfoot. In the third generation there were eight of nineteen children with clubfeet. Four times the abnormality occurred in females. The inheritance was through the female.

AMBERG, Rochester, Minn.

THE BUZZI OPERATION FOR POSTPNEUMONIC EMPYEMA. B. GALLI-VALERIO, Schweiz. med. Wchnschr. **55**:181, 1925.

The author pleads for a wider usage of an operation for empyema which was first employed by Dr. Francesco Buzzi, and which was successfully carried out for thirty years by physicians in the Alps. The operation requires an instrument also designed by Buzzi. The operation has proved effective in children suffering from empyema.

ELTERICH, JR., Pittsburgh.

Miscellaneous

THE ORGANIZATION OF A SPECIAL CLINIC. EDWIN T. WYMAN and CHARLES A. WEYMULLER, J. A. M. A. **83**:1479 (Nov. 8) 1924.

In 1923, a special clinic for the treatment of rickets was organized in the outpatient department of the children's hospital, Boston. Ultraviolet rays alone were used in eighty-six cases, the patients coming for treatment three times a week. The authors conclude from their observations that acute rickets can be cured in an outpatient department by ultraviolet irradiation alone, but that the healing processes are probably hastened by the addition of cod liver oil therapy. Ultraviolet irradiation three times a week prevents the development of rickets. They suggest the use of quartz windows in every nursery so that the baby can have its daily sun bath in a warm room, and believe that a simple electric quartz bulb could be devised which would give off sufficient actinic rays with short exposures to prevent the occurrence of rickets in babies. The authors are of the opinion that ultraviolet rays seem to accomplish a complete cure for rickets more than any other therapeutic agent alone, although their action may be aided by proper dietetic and hygienic measures and the administration of cod liver oil.

HEREDITARY ANKYLOSIS OF THE PROXIMAL PHALANGEAL JOINTS. DAN COLLIER ELKIN, J. A. M. A. **84**:509 (Feb. 14) 1925.

A case of hereditary ankylosis of the phalangeal joints (symphalangism) is reported. The trait was found to have been carried through five generations.

FIVE SUCCESSIVE GENERATIONS OF WEBBED FINGER DEFORMITY. DOUGLAS P. MURPHY, J. A. M. A. **84**:576 (Feb. 21) 1925.

In the family presented here, the groups within the whole have been large and the deformity has occurred with considerable frequency. The chief point of interest is that the deformity is apparently never transmitted to any of the grandchildren when the parent is clear.

A STUDY IN MATERNAL AND FAMILIAL HYGIENE. GAMGEE, Arch. de méd. d. enf. **27**:669 (Nov.) 1924.

In an analysis of five hundred families of the working class in the port of Hull, several surprising conclusions were reached. No facts could be found to substantiate the opinion that a large family makes the mother and children unhealthy. Even though hygienic conditions in small families (less than five children) were better, the mothers and children were less healthy. The young mother of the poor classes is prone to use artificial feedings.

A CASE OF MEDICINAL ANAPHYLAXIS. A. VAZ, Arch. de méd. d. enf. **27**:674 (Nov.) 1924.

Following the application of a linseed poultice to the abdomen of a child, aged 4 years, marked palpebral and facial edema, with erythema of the thorax and extremities and a vesicular eruption over the abdomen occurred. When the poultices were discontinued, recovery followed.

BONAR, Salt Lake City.

INTRAPERITONEAL BLOOD INFUSION. OBSERVATIONS ON ANIMALS AND MAN. HANS OPITZ and FELIX METIS, Jahrb. f. Kinderh. **107**:269, 1924.

The absorption of blood from the peritoneal cavity was studied in dogs and rabbits by laparotomy and at necropsy; in human patients by blood counts and hemoglobin determinations at various intervals after transfusion. There was a great deal of individual variation, but the defibrinated and citrated blood were soon absorbed. The liquid and cell elements were found to enter the circulation within from 4 to 16 hours, and this process continued for three or four days until all was absorbed. The liquid part of the blood was absorbed more rapidly than the formed elements. No changes were noted in the abdominal organs or in the peritoneum after transfusion. Reactions were less frequent and milder than after intravenous transfusion. Protocols are included.

SUTHERLAND, Chicago.

ON "HOSPITALISMUS" IN INSTITUTIONS FOR CHILDREN. ZAIDA ERICKSSON, Acta Pediat. (Supplement) **4**:7 (Feb.) 1925.

This is an extensive statistical study of children from institutions in Munich as compared with those brought up in private homes. The author has made

careful observations on mental and physical development and on the incidence and prognosis of most of the common diseases of childhood.

The children from institutions were definitely backward in their physical development. This was more conspicuous in length and breadth measurements than in weight. No difference in the size of the head could be detected.

The institution children were also pale and had inferior muscular development. They slept poorly and their cry was not so lusty. Mental development was behind that of the children in private homes, and sphincter control in particular was acquired at a later date.

The institution children showed a lessened resistance to infectious diseases, such as measles, diphtheria and pneumonia, as well as to nutritional disturbances. The mortality from these conditions was considerably greater.

The author concludes that the chief cause of this so-called "institutional injury" is the increased frequency of infections, and particularly the early exposure to the contagious diseases. Lack of individual care is also a factor of some importance. Rickets occurs more frequently in institutions, and this probably reduces the resistance to other diseases even more.

This article contains an interesting historical survey of the development of institutions caring for children, and the conditions in such institutions in different parts of the world.

HOLT, Baltimore.

OBSERVATIONS RESPECTING THE SENSE OF PAIN IN SKIN EXPOSED TO ULTRA-VIOLET RAYS. V. MALMSTRÖM, Acta radiol. **3**:327 (Aug.) 1924.

This investigator has observed hyperalgesia, following exposure to either sunlight or the rays of the quartz lamp, during the latent period after the heat erythema has subsided and before the light erythema has appeared. It was also observed that sensations following contact with sharp or dull objects at such a time were abnormally prolonged, and painful sensations once produced continued and were localized in spite of procain anesthesia at the site sufficient to prevent recording of new impulses. These same sensory reactions were observed after subsidence of ultraviolet light erythemas. When the rays were passed through a quartz vessel containing a 1 per cent. solution of quinin sulphate, which completely absorbs all ultraviolet rays, there were no changes in skin sensation reactions in patients who otherwise reacted in the manner described above. These reactions are attributed to a direct light action on the intra-epithelial nerve endings for pain perception, which reaction is thought to lower the threshhold-value of such perception. It is also thought to increase the range of activity of these nerve endings.

An Alrutz algesimeter and a 220-volt quartz burner were employed in the experiments. The exposure time was from four to five minutes, the distance 25 cm. and the volar side of the arm was the area usually exposed.

Twenty-one experiments were carried out and carefully checked and controlled. The physiologic considerations of pain perception were discussed.

H. R. FOERSTER, Milwaukee.

Society Transactions

CHICAGO PEDIATRIC SOCIETY

Sarah Morris Memorial, Michael Reese Hospital

Clinical Meeting, Feb. 17, 1925

H. W. CHENEY, M.D., *President, in the Chair*

PERINEPHRITIC ABSCESS. Presented by DR. I. H. TUMPEER.

The patient, a boy, aged 10, had had an attack of hematuria six months previously. For two weeks prior to admission to the hospital he had complained of fever, night sweats, nocturia, pain and limitation of motion in the left lumbar region. During this period he had lost 5 pounds (2 kg.) in weight. On entrance to the hospital, he manifested a bulging over the left lumbar region, which fitted into the palm of the examining hand, exquisite tenderness over the area, pain on motion of the part or extension of the thigh. The temperature was high and leukocytosis was present. Involvement of spine, sacro-iliac region and hip joint was excluded by roentgen-ray examination and the Pirquet test. Aspiration yielded pus, confirming the diagnosis of perinephritic abscess. Following operation, the child's symptoms subsided and he regained the lost weight.

NONTUBERCULOUS MEDIASTINAL ADENOPATHY. Presented by DR. I. H. TUMPEER.

The patient, an infant, aged 16 weeks, was admitted to the hospital because of cyanotic spells which had recurred at intervals for four days, following a cough of one week's duration with an afebrile course. There had been loss of weight for two weeks, but there was nothing important in the history except the respiratory difficulty. On admittance, the chest was full of râles, there was softening of the cranial bones, Chvostek and Trousseau signs were present; some increased mediastinal dulness was also noted, and there was a shadow in the roentgenogram indicating a large thymus. Three roentgen-ray treatments were given and the shadow decreased, but the symptoms continued. The white count was between 11,000 and 16,000 with no increase of lymphocytes; there was no vomiting nor whooping and cultures contained no *B. pertussis*, which seemed to rule out whooping cough. On palpation a bony projection was found in the pharynx, but it was high up and did not seem to be causing the difficulty. Because of the suggestive Chvostek and Trousseau signs and the severe paroxysms, which at times required artificial respiration to overcome, bronchotetany was considered, but the electric reaction was not increased and the calcium content was normal, although taken a few days after blood transfusion. Atropin had been administered, without results. In a lateral roentgenogram, a mass was seen pressing on the trachea from behind. The condition apparently was a respiratory difficulty due to mediastinal adenopathy, probably nontuberculous because the Pirquet test was negative. It was thought that the condition might be due to a low-grade infection acquired from an older brother, who was ill at the time the infant was taken sick.

HENOCH'S PURPURA. Presented by DR. CALVIN.

The patient, a boy, aged 5 years, was apparently perfectly well until three weeks previous to examination when he developed what the mother said was a "cold," which was accompanied with abdominal pain. No doctor was called until five days before presentation, when petechial hemorrhages occurred on the legs, accompanied by arthritic pains which shifted from one joint to another. The hemorrhagic spots were small and appeared in groups. The abdominal pain had increased in severity, was paroxysmal and accompanied by vomiting. Blood had been passed in the stools for several days. The arthritic pains had ceased, but various parts of the body were still swollen. Urinalysis revealed a small number of red and white blood cells and a small amount of albumin. The blood findings were normal and the condition was considered a classical case of Henoch's purpura, probably due to a primary infection in the nose. The temperature had not gone above 100 F. per rectum.

DISCUSSION

DR. JOSEPH BRENNEMANN asked if a mass had been found in the abdomen.

DR. CALVIN said there had been no persistent mass. The petechial hemorrhages originally appeared along the lower part of the leg, and as they disappeared there they appeared in other places. There had been definite pitting of the ankles at times but this had lasted for only a few hours.

MESENTERIC GLANDS. Presented by DR. ROSENBLUM.

The patient, aged 16 months, had been well until about four and a half weeks before examination when a slight elevation of temperature occurred. The physician did not see the child until he had been ill for five days. At that time the temperature was 103 F. There had been no vomiting until two days previously and then very little. The eyes were sunken and the child looked toxic. The right side of the abdomen was definitely rigid but no mass could be made out. The white cell count was 16,000; the urine was negative. Two days later the temperature was still 103 F., there was no vomiting and the bowels were regular, but the physician advised removing the child to the hospital. After getting the abdomen somewhat relaxed, he could feel what he thought was a mass in the right side. There had been no blood in the stools and the appetite had remained good. Drs. Abt and Hess saw the child in consultation, and all thought that the diagnosis lay between acute appendicitis, a mass of glands or a malignancy. Under ether relaxation an irregular mass of glands could be felt, the lower limit of which extended to a point on a line between the umbilicus and an anterior superior spine, at least 3 inches (7 cm.) long and quite hard. The temperature dropped from 102 to 100 F., where is remained for five days, but the leukocyte count remained around 20,000. Operation was advised but revealed only a mass of mesenteric glands. The Pirquet test was positive, and histologic examination showed tubercle formation. Following operation, the child improved, the temperature dropped to 100.2 F., and roentgenotherapy was instituted for the glands. It was thought that possibly the trouble was due to an acute infection which had activated an old tuberculous process. There was no fluid in the abdomen at operation.

DISCUSSION

DR. H. W. CHENEY asked if there was any possibility of infection from milk.

DR. ROSENBLUM thought there was not, because the milk had been boiled all the time.

Dr. Ralph B. Bettman said that at operation a large mass was found which seemed to originate from under the cecum. It was from 2 to 3 inches (from 5 to 7 cm.) long, 1 inch (2 cm.) in diameter, and along the ileum were numerous large glands, which became smaller as they got further away from the cecum, and stopped at a distance of 4 or 5 inches. He did not think that they were tuberculous glands because they were so firm, but thought possibly they had to deal with a neoplasm; he was surprised to have the pathologic report stating that there was tubercle formation.

Multiple Cartilagenous Exostoses. Presented by Dr. Ethel M. Davis.

The patient, a boy, aged 11, first entered the hospital one and one-half years prior to examination, because of swellings about the ankles, knees, elbows and wrists and on the chest. The condition had been present since he was 6 years old but was gradually becoming worse. There were occasional mild arthritic pains but no acute swelling. He had had the usual diseases of childhood, and a mastoid operation three years ago. When first seen, the blood count was normal and the urine showed no Bence-Jones reaction. A syphilitic infection was not suspected, but the Wassermann reaction was found to be 4+ with the blood of the patient and his mother, although the father's blood was negative. The patient then received a course of antisyphilitic treatment, following which the Wassermann reaction became negative. This was followed by a course of neo-arsphenamin, but the blood again became positive in all antigens.

When the patient was first in the hospital, roentgen-ray examination showed the exostoses to be partially bony and partially cartilaginous, with no evidence of syphilitic bone involvement. Following the antisyphilitic therapy, there was little change apparent in the exostoses, except some increase in size in those about the distal metaphysis of the femur. No new lesions had been noted.

In spite of the existence of the syphilitic infection, the condition was thought to be of the congenital type of multiple cartilaginous exostoses, although there was no history of this condition in the family. Tuberculosis and rickets have been considered as etiologic factors in these cases.

The blood calcium, 11.4 gm., and the phosphorus 4.9 gm., was within normal limits in this boy and further metabolic studies are being made. Underhill and Bogert recently demonstrated a negative calcium balance in two cases studied by them.

In the exostosis removed for examination, the arrangement of the cartilage cells was somewhat irregular.

DISCUSSION

Dr. Mark Jampolis said that no new growths had developed in the patient he showed last year, in whom the condition was very similar, and the exostoses were not as prominent as they were since the patient had been on a diet including cod liver oil and calcium.

Diabetes. Presented by Dr. Jampolis.

A boy, aged 11, was first seen in May, 1923, with a mild attack of diabetes. At the end of the summer of 1924 he was run over by an automobile and sustained a compound fracture of the leg. When brought to the hospital large amounts of sugar in both urine and blood were noted. He did not always respond to insulin treatment, and there was difficulty in keeping him

on a low maintenance diet. The surgeon then found pus in the wound, which apparently had healed; when this was cleaned up the patient again responded to treatment. At the time of presentation the child had much more than a maintenance diet, the insulin was down to 12 units a day and he was in much better condition. The case was interesting because of the effect of the fracture and its influence on the sugar tolerance of the patient.

MULTIPLE SCLEROSIS. Presented by DR. WITT.

The patient, a girl, aged 9½ years, first came under observation a year and a half before this presentation, when she was admitted to the hospital a few hours after a convulsive seizure which involved the left arm and leg. The history stated that when she was 4½ years old, she suddenly became blind. She was unable to read but probably had the power of distinguishing light from dark. The blindness soon cleared up but was followed by paralysis of the extremities, which was most marked in the arms at first and was of a spastic character. The condition of the arms soon improved, to be followed by spasticity of the legs. The child was confined to bed for four or five weeks, gradually improved, being able to walk with a spastic gait which became normal after five or six weeks. She then had a recurrence of the spasticity which persisted for some time. Three years ago, she developed peculiar seizures; she did not lose consciousness while standing or sitting, but was said to tremble and then fall to the ground. These attacks occurred at intervals of from four to five days to several a day, but soon changed and became definitely epileptiform in character. When the child was first admitted to the hospital she had a definite left-sided hemiplegia, but the diagnosis was uncertain. She was again admitted to the hospital about a year ago because of an attack of aphasia, which soon cleared up. She had been in the hospital this time since August, 1924, when she was readmitted because of difficulty in speech and gait and these symptoms had varied during this period. She had had but one convulsion during this period, which was easily controlled by morphin. Her gait was definitely ataxic, her speech was scanning and was not easily understood. There was loss of bladder control, ataxia of the hands as well as of the feet and legs and at times a definite intention tremor, with a fine tremor of the tongue. There was marked exaggeration of the Achilles and knee reflexes and the Babinski and Chaddock signs were both present on both sides. The abdominal reflexes had been persistently absent. Ophthalmoscopic examination by Dr. Harry Gradle showed temporal pallor of both disks.

ANTERIOR POLIOMYELITIS. Presented by DR. KLEIN.

The patient, a boy, aged 11, was admitted on Feb. 5, 1925. Four days previously the boy had returned from school and complained of being tired, of feeling "weak in the legs and arms," and of having sore throat and persistent cough. The weakness gradually increased and was accompanied by pain in the back, legs and arms. He vomited once. On admission to the hospital the boy could not stand or walk; the temperature was 97 F., he looked toxic, his cheeks were flushed and he was in a cold perspiration. Examination revealed flaccid paralysis of the legs and little motion in the extremities. The abdominal and knee reflexes were absent. Lumbar puncture gave a cell count of 5, a positive Noguchi and a negative Wassermann reaction in the cerebrospinal fluid. The Brudzinski sign was positive. On admission,

15 c.c. of Rosenow's serum was administered, but during the next three days the symptoms increased, the patient developed difficulty in swallowing, coughed up sputum and became very cyanotic. A few drops of epinephrin were administered every few hours, and the following day he had improved slightly. On February 10, 15 c.c. of Rosenow's antipoliomyelitis serum was again administered by deep hypodermic injection. At the time of presentation considerable motion had returned to the extremities, the abdominal reflexes were present and the general condition had improved. There was some rash following the administration of the serum.

The condition was thought to be poliomyelitis of the bulbospinal type, simulating Landry's paralysis.

GAUCHER'S DISEASE. Presented by DR. W. BLOOM.

The patient, a boy, aged 6, was admitted to the hospital on Jan. 13, 1925, and discharged on February 7. The parents had always known that the abdomen was large but no attention was paid to it until the boy had a hemorrhage from the nose and the physician who was called found that the child had an enlarged spleen. He had had slight nose bleed for the last three years, at intervals of from two to four weeks. He had vomited after breakfast practically all his life, the vomitus being sour but consisting of food that had just been eaten. Vomiting never occurred after the noon meal or at night. The vomitus never contained blood. There had been no blood in the stools and no petechial hemorrhages had been noted.

Examination showed the abdomen enormously and symmetrically enlarged, the diameter being greater than that of the thorax or hips. There was no tenderness or rigidity. The spleen extended down to the left iliac crest in the axillary line, to below the umbilicus at the midline. It was smooth, firm and not tender. The notch was felt near the umbilicus. The liver could be palpated a hand's breadth below the costal margin, and was smooth, firm and not tender. No fluid was present in the abdomen.

January 14, blood examination showed 2,810,000 red cells, 1,550 white cells, hemoglobin 53 per cent., with neutrophils 34 per cent. and small mononuclears 56 per cent. The Wassermann reaction was negative. There was complete hemolysis with 0.32 per cent. sodium chlorid and partial with 0.4 per cent. sodium chlorid (normal). The Van den Bergh test on the blood by the direct method gave negative results and was within normal limits by the indirect method. Splenectomy was performed on January 20, following the transfusion of 200 c.c. of blood. February 4, the red blood count was 3,090,000, white 3,400, hemoglobin 70 per cent. Convalescence was uninterrupted.

The pathologic report on the spleen read as follows: "The spleen measures 19 by 12.5 by 8 cm. and weighs 650 gm. It is a reddish-orange in color. On section, there are many translucent grayish areas surrounded by a thin red zone. These are circular, vary from 0.5 to 1 mm. in diameter, and are probably malpighian bodies. The rest of the pulp has a peculiar grayish granular appearance. The spleen is somewhat soft." Microscopically, the splenic sinuses and most of the pulp were filled with pale staining giant cells which did not stain with sudan III, and which with certain stains showed the longitudinal striations characteristic of Gaucher's disease. The pathologic diagnosis was Gaucher's splenomegaly.

CONGENITAL DILATATION OF URETERS. Presented by DR. S. EISENSTAEDT.

Roentgenograms of two cases of primary or congenital dilatation of the ureters were presented. The ureters not only were enormously dilated, nearly

the diameter of an adult thumb, but apparently were greatly lengthened, giving the impression that they were much too long for the torso. There was absolutely no obstruction to the urinary stream at any point. The mechanism of this anomaly is not well understood, but it is undoubtedly a congenital defect, probably having to do with a lack of development of the musculature of the ureters. Similar conditions have, in rare instances, been found in the earliest days of life and at the fetus before term. The anomaly is not associated with an obstruction anywhere in the urinary tract. The ureter in the fetus up to the fifth month is normally relatively wide, and the anomaly may simply be due to the lack of muscle fiber development in the wall of the ureter. Both children presented an enormous excentric hypertrophy of the bladder.

EMPYEMA. Presented by DR. RALPH B. BETTMAN.

Dr. Bettman regards the three following dicta as axiomatic in the treatment of acute empyema: 1. The use of a method of treatment which permits of no open pneumothorax, in other words, the closed method. 2. Starting treatment early, as soon as the diagnosis of empyema is made. 3. Continuing treatment until the empyema cavity is completely obliterated.

By the closed method of treatment Dr. Bettman means the insertion of a tube into the empyema cavity by means of a trocar, and the drainage of the chest wall by repeated aspirations with this tube. The tube is held closed between times. In order to liquefy the pus, surgical solution of chlorinated soda is instilled after each aspiration.

The advantage of starting treatment early is that such pathologic changes as the formation of massive adhesions, thickening of the pleura, or multiple encapsulations have not yet occurred. The closed method is without danger at all times.

No empyema can be considered cured, no matter how free of symptoms the patient is or how sterile the cavity seems to be, so long as the cavity itself remains. The cavity must be completely obliterated by the expanding lung, by pulling up the diaphragm or sinking of the chest wall before the patient can definitely be pronounced cured.

NEW ENGLAND PEDIATRIC SOCIETY

Boston, Mass., Feb. 13, 1925

KENNETH D. BLACKFAN, M.D., *in the Chair*

FAT ABSORPTION IN INFANTS (PRELIMINARY REPORT). Presented by DR. RICHARD C. TEFFT.

In an effort to determine accurately: (1) the reaction of an infant to large amounts of fat in the diet, (2) his ability to utilize large amounts of fat, (3) the reaction of varying amounts of fat in the diet on calcium absorption, (4) the reaction of calcium on fat absorption and (5) the reaction of both on the phosphorus absorption, an infant, aged 4 months, was placed on a metabolism frame and fed very carefully controlled and analyzed diets con-

taining varying amounts of fat and calcium. Accurate determinations of the neutral fat, fatty acid, soap and calcium were made on the stools and daily determinations of the phosphorus excreted in the urine.

The amount of fat excreted, almost entirely in the form of soap, the amount of neutral fat being at all times negligible, increased steadily as the amount of fat in the diet increased, but the proportion of fat excreted to the fat intake remained approximately constant at about 10 per cent., indicating that 90 per cent. of the fat taken in the diet was absorbed. When the calcium in the diet was very markedly increased, these proportions changed to 15 per cent. excreted and 85 per cent. absorbed. The phosphorus excretion in the urine rose steadily with increase in the fat intake, until the patient was on a milk mixture containing about 4 per cent. fat, after which it remained about constant despite increases in the fat. On this diet 55 per cent. of the calcium in the stools was excreted in the form of soap. With marked increases in the amount of calcium in the diet the excretion of phosphorus in the urine decreased rapidly, falling practically to zero on a diet consisting of fat free milk with approximately 20 gm. of calcium lactate added daily. Throughout the course of the experiment, the calcium excretion in the stools was roughly 50 per cent. of the intake, indicating the probability that an equal amount of calcium was absorbed. This held when the calcium intake was varied from 0.88 gm. to 3.41 gm. of calcium per day. The only gastro-intestinal disturbance in the course of the experiment was diarrhea occurring during one of the fat free periods. Throughout the experiment the baby gained at a rate somewhat greater than the average for hospital babies of this age.

So far as can be determined from a single case very carefully studied, the following conclusions are indicated:

1. The infant can absorb very large amounts of fat in the diet as efficiently as smaller amounts, and is able to split practically all of the fat supplied.
2. About 10 per cent. of the fat intake is excreted. This is almost entirely in the form of soap, which constitutes, except on diets containing almost no fat, about 50 per cent. of the dried stool weight.
3. Increasing the calcium in the diet has relatively little effect on the fat absorption and increasing the fat has relatively little effect on the calcium absorption.
4. About 50 per cent. of the calcium intake is absorbed.
5. Increasing the fat, within certain limits, tends to increase the phosphorus absorption.
6. Increasing the calcium in the diet lessens the amount of phosphorus absorption and with very low fat diets may entirely inhibit it.

DISCUSSION

DR. TALBOT: The fact that large amounts of fat can be and were given to this child without doing any harm is very interesting, because the impression in this community has been that it was not safe to give such large amounts of fat. I remember when I was first in practice that many children were given from 6 to 8 per cent. of fat for long periods and they apparently did well. Occasionally they would have upsets which were given the name of "fat blow ups." I think these upsets were due to an infection which upset them slightly.

DR. GAMBLE: Did Dr. Tefft find any calcium in the urine?

DR. BLACKFAN: Was any Karo added to these fat free diets?

DR. TEFFT (in closing): In some of these children who were on fat free diets, 3 ounces (89 c.c.) of Karo were added to a 30 ounce (887 c.c.) mixture. We did not do any calcium tests on the urine. We would have, despite the fact that the procedure is somewhat difficult, had we known that the results were going to turn out so interestingly.

BLOOD CHANGES IN DEHYDRATION. Presented by DR. DANIEL C. DARROW.

The water content of infant's blood in various conditions has been the subject of study by a number of workers. Most investigators have been particularly interested in correlating changes in weight, whether a loss or gain, with changes in the water content of the blood. Reiss, in 1909, investigated this problem by studying changes in the refractive index of the blood serum by which means an approximate measure of the serum protein concentration can be obtained. In 1911, Berend and Tezner studied changes in the electrical conductivity, viscosity and refractive index of the blood serum. Lust, in the same year, studied the proportion of blood left by drying. More recently, work on this problem has been done by Utheim in Marriott's clinic. The results of all of these studies are fairly consistent and may be summarized in the following statement: (1) Babies under 1 year of age show diminished serum protein concentration and a relatively increased water content of the blood; (2) the changes in weight during the first days of the infant's life are accompanied by corresponding changes in the serum protein concentration and the water content of the blood; (3) undernourished and artificially fed infants tend to exhibit a low serum protein concentration and a relatively high water content of the blood; (4) patients showing edema show also a low serum protein concentration and a high water content of the blood; (5) patients with a diminished skin turgor and those suffering from intoxication, such as those described by Finkelstein, show an increased serum protein concentration, a diminished water content and an increased proportion of erythrocytes in the blood; (6) the viscosity of the blood tends to follow the level of the percentage by volume of red corpuscles; (7) values for the specific electrical conductivity of the blood serum do not vary in any readily analyzable way but one gains the impression that these tend to remain fairly constant or at least to show no constant variations with changes in the water content of the blood. So far as I have been able to ascertain, freezing point determinations on the blood of infants have never been made.

It seemed desirable to us to establish more definitely the changes occurring in the blood of infants under various conditions, especially with reference to three aspects not adequately treated by previous investigators, namely: (1) the extent of the blood volume change, if any; (2) the extent of the changes in the concentration of electrolytes that may accompany changes in the water content of the blood; (3) the magnitude of the changes that occur in the concentration of the crystalloids. Accordingly, we have studied some sixty patients, the blood specimens from whom we have determined: (1) the serum protein concentration as measured by the refractive index, (2) the electrical conductivity of the serum, (3) the freezing point of the blood serum. In addition, we have determined the volume of the whole blood and the plasma, by the vital dye method, wherever feasible.

The freezing point was determined by means of a thermocouple which we have designed particularly for use where only small amounts of blood are

available. We are convinced that this apparatus gives, with the use of 3 c.c. of serum, results as accurate as those obtained from a Beckmann thermometer which ordinarily requires nearly 15 c.c. of serum.

A tabulation of the results obtained from our study brings out certain very interesting facts. In the first place, taking as dehydrated those patients who showed an increased serum protein concentration, a diminished skin turgor and the ordinary symptoms, we find that both the freezing point and the specific electrical conductivity of the serum lie within the same general range of values as do those of normal persons. Only two out of twelve cases of dehydration showed abnormally high values for electrical conductivity of the serum.

On the other hand, when one considers the blood volume values, striking changes are evident. All of the plasma volumes of dehydrated patients, except one, are found to be 45 c.c. per kilogram of body weight or less, whereas the values for all the normal cases are seen to be 50 c.c. per kilogram of body weight or greater. Three patients who might be considered as belonging within the normal range, showed values for plasma volumes from 45 to 50 c.c. per kilogram of body weight. But these patients rightly, must be considered abnormal. One of them had received hydrochloric acid and this influences the blood volume. Another patient had lobar pneumonia and lobar pneumonia may cause lowering of the blood volume. The third was a case of bacillary dysentery who clinically did not seem to be dehydrated. Among the dehydrated cases, the exception referred to was a patient suffering from celiac disease. This child had gained about 1 kg. in weight in nine days and his plasma volume had increased from 320 to 360 c.c. However, the gain in weight in the body itself was so great that the plasma volume expressed in cubic centimeters per kilogram of body weight dropped only from 57 to 55. Perhaps the contrast between this case of celiac disease and the ordinary dehydrated baby means that it is not without reason that these children have the reputation of exhibiting peculiar changes with respect to their weight curve and their water metabolism.

The changes occurring in dehydration are better illustrated by the five cases in which blood volume determinations were made during the period of dehydration because of a lack of fluid intake during attacks of encephalitis. The changes in their plasma volumes were, in the one, from 477 to 570 c.c. (from 39 to 49 c.c. per kilogram of body weight). One patient with acute diarrhea showed, when sick, a plasma volume of 276 c.c. and on recovery, 434 c.c., an increase from 43 to 62 c.c. per kilogram of body weight. This was an infant, aged 7 months, who gained 500 gm. during the days intervening between the two observations. A baby, aged 1 year, had had recurring attacks of diarrhea and when admitted to the hospital was severely dehydrated. He gained 500 gm. in four days and his plasma volume increased from 200 to 340 c.c. or from 40 to 62 c.c. per kilogram of body weight. The fifth case of celiac disease has been commented on. None of these cases showed any important changes in the freezing point or electrical conductivity of the blood serum.

In cases on which two determinations are done within 10 days, the total amounts of serum protein and red cells are almost the same in the two determinations. This fact allows us to calculate the change in blood volume from the change in serum protein or red cell concentration if we know one of the blood volumes.

It must be borne in mind that, since the plasma usually loses more in water, proportionately, than the rest of the body, the extent of the change in plasma

volume is better represented by results expressed in absolute values than by those expressed in terms of plasma volume per kilogram of weight. One child lost as much as 35 per cent. of his plasma volume and subsequently recovered. It would seem that, in general, since undernourished infants have a low total blood volume, although the plasma volume is high, the condition being really one of oligocythemic hydremia, they probably suffer a sufficient loss of blood volume during dehydration to cause alarming symptoms from this factor alone. In another case which we have studied, the total blood volume was actually less by 10 c.c. per kilogram of body weight than the plasma volume alone should have been for an infant of that age. The patient was suffering from anemia and also showed dehydration resulting from diarrhea; and the dehydration could not be relieved until a transfusion of blood was given. The presence of a certain minimum number of red corpuscles is necessary in order to maintain an adequate blood volume.

Blood volume determinations were done on two cases of renal disease with edema. Both showed marked albuminuria. The condition in one of the patients corresponded to the type of case entitled nephrosis by Epstein. Both patients showed marked decrease in the plasma volume relative to body weight. One might infer that, in reality, this was only an apparent decrease, due to excessive storage of water in the tissues. But the diminution was such that the plasma volume per kilogram of body weight amounted to only 29 c.c. in the one and 28 c.c. in the other, values too low to permit being accounted for reasonably on the basis of a storage of water in the tissues. Not only a great relative but also an absolute decrease in plasma volume must have occurred.

From our observations the following conclusions may be drawn:

1. In patients with dehydration the loss of plasma volume is usually greater, proportionately, than the loss of weight by the rest of the body.

2. In cases of dehydration, generally speaking, no important changes occur in the freezing point or in the specific conductivity of the blood serum. Indeed, except for the diminution in the total blood volume and the plasma volume, there is very little abnormal about the blood of these dehydrated infants. Of course, these methods can tell us little about the quantitative disturbances relating to particular dissolved substances in the blood.

DISCUSSION

DR. BLACKFAN: This is a good opportunity for some of us to ask questions. Such a careful study of dehydration is of intense interest to many. There are, as we know, a number of clinical features in the dehydrated child which have been greatly confused.

I think Dr. Darrow might have told us something about the relative value of transfusion and also about the treatment of these dehydrated children. He obviously had an opportunity for studying that phase of the condition.

DR. HAMILTON: I notice that the calcium chlorids were nearly normal in all cases.

Is vomiting an important symptom in causing dehydration?

DR. TALBOT: Was there any evidence of acidosis in these cases?

DR. DARROW (in closing): I think that three or four patients in my series had attacks of vomiting.

With regard to treatment, whole lactic acid milk with sugar were given and subcutaneous sodium chlorid solutions were also given. The severe dehydrated patients were given glucose intravenously.

Two or three of the patients whom I showed you this evening did have acidosis, but it was not a prominent symptom.

A THEORY CONCERNING THE TRANSFUSION OF WATER. Presented by DR. THOMAS E. BUCKMAN.

Following the demonstration by Starling in 1896 that the proteins of the blood plasma exert a definite osmotic pressure (from 30 to 40 mm. of mercury), the theory has been elaborated that the resorption of water from the lymph spaces surrounding the capillary meshwork can be accounted for by the fall in the hydrostatic pressure of the blood. For, assuming that the capillary walls are permeable to all dissolved substances except the colloids and, letting

l = the osmotic pressure exerted by colloids of the lymph,
p = the osmotic pressure exerted by colloids of the plasma,
a = the hydrostatic pressure of the blood on the arterial side,
and v = the hydrostatic pressure of the blood on the venous side,
then, on the arterial side of the capillary meshwork,
$p - a < l$ and a transfusion of water into the lymph spaces occurs
and, on the venous side of the capillary meshwork,
$p - > l$ and a transfusion of water into the blood occurs.

Although such a mechanism may account for a certain amount of water resorption, it is our purpose to show that another possible mechanism might reasonably be expected to influence not only the resorption of water from the tissues but also the elimination of water in the lungs.

The basis of our conception is the series of events occurring when blood is exposed to varying tensions of carbon dioxid and oxygen, in particular, the increase in the freezing point depression of the plasma and the diminution of the chlorid content of the plasma that occurs as the carbon dioxid tension to which the blood is exposed increases. The change may be represented by the equation:

$$RNH_2 + NaCl + H_2CO_3 = RNH_2HCl + NaHCO_3$$

In this equation, the expression, RNH_2 represents the free amino-groups of the proteins of the corpuscles. (Corresponding reactions probably take place also within the cells and within the plasma.) The plasma loses sodium chlorid and gains sodium bicarbonate. The cells gain hydrochloric acid in the form of aminohydrochlorid. But sodium bicarbonate and sodium chlorid are about equally dissociated whereas aminohydrochlorid is more dissociated than the amin. The net result is a gain in particles by the cells while the plasma suffers no change. Following this, water flows into the red cells from the plasma; the volume of the corpuscles increases; the plasma becomes more concentrated.

In vitro, the increase in the concentration of the plasma with increasing carbon dioxid tension is readily demonstrable; in the body, venous plasma shows a very much smaller increment in concentration over the concentration of the arterial plasma than would be expected from a consideration of the increment resulting, in vitro, from an increase in carbon dioxid tension corresponding to the difference between the carbon dioxid tension of tissues and lungs. Presumably, in the body, water flows into the venous plasma to restore the equilibrium and presumably, also, the reverse change occurs in the lungs. At least, in either case, the conditions are favorable for such a transfusion of water.

The increment in the concentration of crystalloides in the plasma with increasing carbon dioxid tension is proportional, generally, to the increment in the bound bicarbonate content of the plasma. The shape of the carbon dioxid curve, in a given case, thus influences the transfusion of water.

The level of the bound bicarbonate content of the blood at any given tension of carbon dioxid, among other factors, influences the shape of the carbon dioxid dissociation curve. There appears to be an optimum initial content of bound bicarbonate for the production of the greatest increase in concentration of crystalloids in the plasma as the blood passes from an atmosphere corresponding to that in the lungs to conditions of gaseous tension obtaining in the tissues.

As the level of the bicarbonate content of the blood sinks, hypocapnia (compensated acidosis), provided it does not fall too far, the gradient of the curve is increased and conditions become especially favorable for the resorption of water and dehydration may result. On the other hand, as the level of the bicarbonate content of the blood increases, hypercapnia (compensated alkalosis), the gradient of the curve diminishes and conditions for the resorption of water may become so unfavorable that edema is evident.

For another reason, apparently, a flattening of the dissociation curve occurs in severe anemia, and, in such cases edema frequently results.

But it is not only changes in the shape of the carbon dioxid dissociation curve that may influence the resorption of water. If for any reason the normal difference between arterial and venous gaseous conditions is not maintained, then, even with a curve of normal gradient, conditions may become so unfavorable as to result in edema. This, apparently, is what happens in lobar pneumonia and there is reason to believe that such a state of affairs may obtain in cardiac decompensation.

It is pointed out that, in the light of this conception, it would be of interest to re-examine the problem of dehydration in infants and also such problems as the elimination of water by the kidneys, the absorption of water from the gastro-intestinal tract, the secretion of hydrochloric acid by the stomach and the influence of calcium chlorid on edema.

Book Reviews

RHEUMATIC HEART DISEASE. By CAREY F. COOMBS, M.D., F.R.C.P. Price, $4.50. Pp. 376. Illustrated. New York: William Wood & Co.

The organization of heart societies has stimulated greatly the effort toward a more thorough understanding of the heart and its diseases. Many important facts have been revealed and a mass of interesting statistics have been recorded. Much of this new knowledge, together with previously existing facts, has been scattered through the literature and has been badly in need of correlation and systematic presentation. It is this need that the author has undertaken to fill. His object, as he states it is: " . . . a summary of studies which have occupied over twenty years, both for the help of those who would like to know how the matter stands at the present day, and also perhaps for the guidance of some who would like to investigate all the as yet unexplored areas of this field of medicine." In general, the aim of the author is adequately accomplished.

The book is well organized and is written in the well mannered style of most English authors. Much scientific data are included, but are presented largely from a clinician's point of view. The chapter on etiology strongly favors the diplococcus rheumaticus of Poynton and Paine as the infecting organism, but frankly presents the opposing arguments.

Many interesting facts from the author's personal observations over a long period of intensive cardiac study are detailed under the chapter entitled "Course and Prognosis." Much of this data were accumulated with great difficulty and are extremely valuable, but the facts might have been presented more clearly if a more extensive use of tables and graphic charts had been employed. This method of summarization is lacking generally throughout the book, which would have added greatly to the availability of the mass of material presented.

The value of the contribution calls for a much better edition than the publishers have given it.

Since rheumatic heart disease greatly exceeds other types of carditis, and since in the vast majority of cases the condition develops in early life, the book should be of special interest and value to the pediatrician.

DIE UROGENITALERKRANKUNGEN DER KINDER. By F. C. W. VOGEL. Pp. 245. Illustrated. Leipzig: F. C. W. Vogel.

This monograph starts out with a much needed chapter on the physiology of the urinary tract, then takes up in detail the composition of the urine. This is up to date and exhaustive and forms a fine background for the rest of the monograph. The question of history taking and examination of the patient is then exhaustively considered together with urine examination.

The second chapter deals with the diseased condition of the urinary organisms, starting out with the chapter on enuresis which is fully considered. Diabetes insipidus is also commented on here.

It is impossible to elaborate on the various sections of this book, but the chapters on nephritis might be mentioned. These are quite exhaustive, but the classification is so involved that it is exceedingly hard to tell just where one nephritic condition leaves off and another begins.

If there is any criticism of the book it lies in this exhaustive but confused consideration of nephritis in children. The congenital deformities are well considered and the chapter on pyelocystitis is excellent. The book is most beautifully illustrated with some colored plates and on the whole, is the best volume on the subject which has yet appeared.

DIAGNOSTISCHE UND THERAPEUTISCHE IRRTÜMER UND DEREN VERHÜTÜNG, KRANKHEITEN DER RESPIRATIONSORGANE, DES HERGENS UND DER UROGENITALORGANE. By PROF. LEO LANGSTEIN. Leipzig: Georg Theime, 1924.

This brochure of eighty-seven pages including index, presents in a readable fashion some common errors in the diagnosis of certain diseases of childhood. Without attempting to be too inclusive, the author's presentation of his own valuable experience, and his fine critical interpretations, make this little paper backed volume a worth-while addition to the pediatrician's bookshelf.

In the section on respiratory diseases are some interesting ideas of the author on such mooted points as the causes of congenital stridor, of congenital atelectasis and of bronchotetany. Langstein regards congenital atelectasis as a sequence of asphyxia, rather than as a cause of it. The asphyxia he interprets as due to cerebral hemorrhage or some other irritation of the respiratory center.

The booklet is enriched with several interesting roentgenograms and some well chosen illustrative cases. Careful interpretation of roentgen-ray plates is dwelt on; warning is directed at the differentiation of connective tissue thickening and pleural thickening in pictures of bronchopneumonia, of the diagnostic importance of pictures in bronchiectasis, diaphragmatic hernias and iodiopathic cardiac hypertrophy.

While accepting Forthmann's description of congenital heart anomalies, Langstein indicates the difficulty of differentiating them, and his clinical observations reflect the unusual acumen of this pediatrician.

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